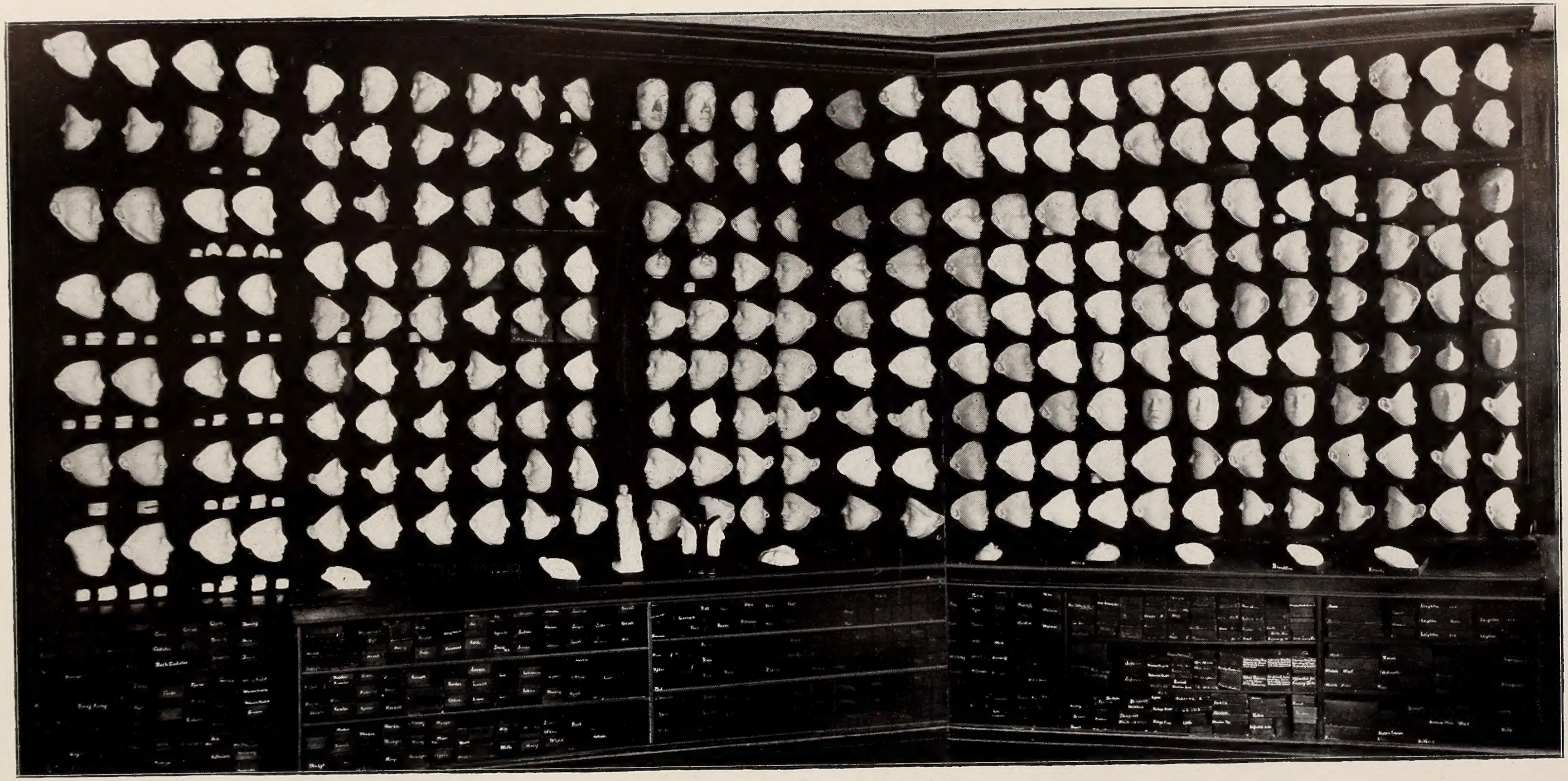
CASE

C.A. Corrigan

DENTAL ORTHOPEDIA



The above illustration represents a corner in the model room of the author's office in 1905. One can get something of an idea of the number of cases upon which the deductions of the present work are founded by remembering that only about one-sixth of orthodontia cases are afflicted with marked dento-facial deformities that call for facial casts.

A PRACTICAL TREATISE

ON THE

TECHNICS AND PRINCIPLES

OF

DENTAL ORTHOPEDIA

INCLUDING

DRAWINGS AND WORKING DETAILS OF APPLIANCES AND APPARATUS FOR ALL FORMS OF IRREGULARITIES OF THE TEETH

BY

CALVIN S. CASE, D. D. S., M. D.

PROFESSOR OF ORTHODONTIA, CHICAGO COLLEGE OF DENTAL SURGERY. FORMERLY, DEMONSTRATOR OF PROSTHETIC DENTISTRY, UNIV. OF MICH.: PROFESSOR OF ORTHODONTIA W. R. U.; AND PROFESSOR OF PROSTHETIC DENTISTRY AND ORTHODONTIA C. C. OF D. S. AUTHOR OF "FACIAL AND ORAL DEFORMITIES;" "THE DEVELOPMENT OF ESTHETIC FACIAL CONTOURS," IN THE AMERICAN TEXT BOOK OF OPERATIVE DENTISTRY, ETC. MEMBER OF THE INTERNATIONAL DENTAL AND INTERNATIONAL MEDICAL ASSOCIATIONS; NATIONAL DENTAL ASSOCIATION; ILLINOIS STATE DENTAL SOCIETY; HONORARY MEMBER FIRST DISTRICT DENTAL SOCIETY NEW YORK CITY; HONORARY MEMBER OF THE ODONTOLOGICAL SOCIETY OF NEW YORK CITY; AND MEMBER OF ALL CHICAGO DENTAL SOCIETIES

CHICAGO
PUBLISHED BY THE C. S. CASE COMPANY
1908

The Lakeside Press
R. R. DONNELLEY & SONS COMPANY, PRINTERS
CHICAGO

To my friends and all who are interested in the highest possibilities of Dental Orthopedia, this book is respectfully dedicated

PREFACE

This work is not intended as an unabridged treatise on the principles and practice of Orthopedic Dentistry, but it is one that is especially designed for teaching the technics and practical principles of correcting dental and dento-facial irregularities in colleges where thorough training is desired. It will also be found convenient and instructive as a reference book in practice.

In the presentation of the work there has been an endeavor to systematically arrange the different branches in the sequence that would develop in the natural demands of training and practice. It commences with the commercially prepared material and carries the work through the several progressive stages to the final construction and adjustment of regulating apparatus and retaining appliances. It deals concisely with general and special principles relative to the application of force, diagnosis, classification, causes, treatment, and retention. The description of specific methods of correction commences with simple and complex irregularities that are most common in practice and progresses through the characteristic types that are susceptible of classification, with a view to a systematic arrangement especially useful in teaching, and also useful to those who contemplate operations of regulating.

An important feature of the work is the employment of the half-tone illustrations selected from the author's practice to illustrate from a practical standpoint the several classes of dento-facial deformities and the results of correction.

Lengthy and verbose histories of cases, with detailed account of the successive methods and steps that were pursued, which would in all probability never be the same even in two apparently similar cases by the same operator, will not be found in this work. The time will be far more profitably spent in a study of the underlying principles of the science — in the acquirement of the peculiar knowledge that is essential to diagnosis and treatment; and in gaining an intimate knowledge of the principles of mechanical forces and technic methods of applying them to a single tooth, so as to move it in every possible direction.

Realizing how difficult it is for students to gain a clear conception of some of the underlying principles of this branch of dentistry, the author has not refrained from repeating many times throughout the work the same ideas, and whenever the particular subject in hand has seemed to demand it. This will be found especially true in regard to the principles of occlusion in its various phases and relations to the art of correction and retention.

On account of the large number of irregularities treated in this work, with nearly every malposition that is common to the teeth, and the variety of forms of

the appliances applicable for their correction, the system will doubtless appear to the casual observer as more or less complicated. But if such an one carefully considers the proposition here presented, i. e., that a systematic arrangement and classification of every distinctive character of irregularity will enable him to readily and surely find in the illustrations a malposition that is similar to the one which he wishes to treat, with every technic instruction for the construction or purchase of the whole or any part of an apparatus that is scientifically applicable for its correction, I am confident he will never again resort to other methods whose greatest recommendation is their apparent simplicity.

While it is always desirable to simplify the apparatus and methods of applying force to the teeth, the attempt to use certain methods or appliances solely because of their apparent simplicity, which may be inadequate to meet the special requirements of the case, greatly increases the difficulties of the operation and often is the sole cause of failure. In fact, simplicity of treatment, ease and satisfaction in the adjustment and management of regulating appliances, and comfort to the patient are always in proportion to the special adaptability and adequacy of the apparatus to successfully accomplish the work. Even this would fail without the skill of an operator capable of making slight but important variations in its construction or adjustments; of determining when, where and how to apply the force, and especially when to reduce or stop it and change the whole or parts of the appliances for methods or variations that more fully meet the demands of the changed and changing conditions.

A grateful appreciation is most heartily acknowledged for the aid derived from the teachings of others, to whom honor is due for the upbuilding of this branch of dentistry; and while the work will be found free from any attempt to copy the various published methods, it is not that I undervalue their importance nor that I am unconscious of the fact that the system here presented is largely permeated by and dependent in many of its important principles on the work of others, but principally because I have aimed to teach only that which has been practically applied in my own practice. Whenever I have directly culled from the work of others, however, or employed methods that could be located in the field of common property literature, due credit is given. Dr. Angle has truly observed: "To fair minds, recorded dates are usually sufficient evidence of priority."

To the men of this country to whom I am particularly indebted may be mentioned, Drs. Kingsley, Farrar, Angle, Black, Guilford, Goddard, Matteson, Cryer, Jackson, and others.

I am especially indebted to my son, Dr. Carl B. Case, for many important suggestions; the invention and improvement of numberless ingenious and effective appliances, instruments, etc., and also for valuable aid in the preparation of drawings which illustrate this work.

CONTENTS

INTRODUCTORY CHAPTER

PRINCIPLES OF TEACHING AND NOMENCLATURE

PART I

TECHNICS OF DENTAL DENTAL ORTHOPEDIA

CHAPTER I

TECHNIC PREPARATION OF STOCK MATERIAL AND IMPLEMENTS

CHAPTER II

STOCK APPLIANCES

CHAPTER III

IMPRESSIONS AND CASTS

CHAPTER IV

PRACTICAL CONSTRUCTION OF REGULATING BANDS

CHAPTER V

CONSTRUCTION OF REGULATING BANDS IN DETAIL

PART II

PRIMARY PRINCIPLES OF DENTAL ORTHOPEDIA

CHAPTER VI

PRINCIPLES OF MECHANICS IN THE MOVEMENT OF TEETH

CHAPTER VII

PRINCIPLES AND TECHNICS OF DENTAL ANCHORAGE

CHAPTER VIII

PRINCIPLES OF INTERMAXILLARY AND OCCIPITAL FORCE

CHAPTER IX

PRELIMINARY PRINCIPLES OF PRACTICE

PART III

PRIMARY PRINCIPLES OF DIAGNOSIS AND TREATMENT

CHAPTER X

ARRANGEMENT OF THE TEETH AND ALVEOLAR PROCESS ANATOMICALLY CONSIDERED. FROM BLACK'S DENTAL ANATOMY

CHAPTER XI

TYPICAL AND ATYPICAL OCCLUSION OF TEETH IN RELATION TO THE CORRECTION OF IRREGULARITIES

BY MATTHEW H. CRYER, M.D., D.D.S.

CHAPTER XII

PRINCIPLES OF OCCLUSION AND DENTO-FACIAL RELATION, INCLUDING A REVIEW OF THE "NEW SCHOOL" TEACHINGS

CHAPTER XIII

CHAPTER XIV

THE QUESTION OF EXTRACTION IN ORTHOPEDIC DENTISTRY

CHAPTER XV

DENTO-FACIAL DIAGNOSIS

CHAPTER XVI

PART IV

SIMPLE AND COMPLEX MALPOSITIONS

CHAPTER XVII

GROUP I. INTRUSION AND EXTRUSION

CHAPTER XVIII

GROUP II. MALALIGNMENTS

CHAPTER XIX

GROUP III. MALTURNED TEETH

CHAPTER XX

GROUP IV. ARCHES

CHAPTER XXI

GROUP V. ABNORMAL INTERPROXIMATE SPACES

CHAPTER XXII

GROUP VI. IMPACTED TEETH

PART V

DENTO-FACIAL IRREGULARITIES

CHAPTER XXIII

CLASS I. MALERUPTION OF THE CUSPIDS

CHAPTER XXIV

CHAPTER XXV

TYPE A. CLASS I. UNILATERAL MALERUPTION OF CUSPIDS

CHAPTER XXVI

TYPE B. CLASS I. BILATERAL MALERUPTION OF CUSPIDS

CHAPTER XXVII

CLASS II. PROTRUSION OF THE UPPER TEETH

CHAPTER XXVIII

CHAPTER XXIX

CHAPTER XXX

CHAPTER XXXI

CHAPTER XXXII

CHAPTER XXXIII

CLASS III. RETRUSION OF THE LOWER TEETH WITH UPPER NORMAL

CHAPTER XXXIV

CHAPTER XXXV

INTRODUCTORY

PRINCIPLES OF TEACHING AND NOMENCLATURE

TEACHING

There exists at present much difference of opinion as to what should constitute Orthodontia technic teaching in colleges. Those who hold to the theory that there are, in the main, only three classes of irregularity which are characterized solely by their relations to normal occlusion, and which may be corrected with a few simple purchasable appliances, naturally take the ground that all training in the mechanical construction of regulating bands and appliances is a waste of valuable time, and of no practical advantage in practice. While others who hold to broader views believe that it requires but very little experience in the true practice of orthopedic dentistry to convince one that he is dealing with the application of mechanical forces, in which will frequently arise demands whose solution is largely dependent upon his own mechanical skill to make important changes or to partially construct parts of appliances to meet special needs that would be difficult if not impossible to purchase. If an extensive practice finally prevents him from doing this work himself, he will be all the better equipped to know exactly what forces are applicable and obtainable, and how to direct others in supplying his needs. Proper training in colleges and elsewhere in the elementary requirements of the work is conducive to that individuality of thought and action which is an indispensable qualification of advanced practice in this branch. It is believed, moreover, that such a practice demands the display of a high order of ingenuity and an intimate knowledge of the laws and principles of art and mechanics which pertain to this department.

Realizing that college classes in Orthodontia technics under the author's direction were, in former years, obliged to spend too much time on the preliminary work of constructing stock material and implements, and consequently not enough time upon the more practical stages of the technic work, the following rules were adopted with the most marked improvement in the practical training of students: First, that students should be taught in the technics of Orthodontia only that which will be useful to them in actual practice: Second, that the Junior students should be thoroughly trained in that portion of the technics which they may be called upon to practically apply in the Senior infirmary practice: Third, that the tech-

nic work of the class should be perfectly systematized and pursued along practical lines, and consist in no more work than each student can easily and perfectly perform in two half-days of each week for three months: Fourth, that the principal portion of the technic work shall consist in the construction of practical finished material and appliances to be presented for grade markings, and if desirable, become a part of the college stock material for the construction of practical regulating apparatus in the infirmary practice.

In the author's opinion, technic students should be drilled in correct methods of obtaining plaster casts for study, comparison, etc., the separating and measuring of *natural* teeth for bands; the soldering of bands and their various force attachments; the construction of stationary and reciprocating anchorages; the use of the draw and screw plates for the drawing of wire and tubing and the threading of wires and nuts; the threading and tempering of taps; the construction of the simple forms of stock appliances, such as alignment bows, screw-jacks, etc.; and the final finishing and plating of apparatus.

Plaster Casts.— Dentists, as a rule, have such a slovenly way of preparing dental plaster casts it would indicate that training in this branch in most colleges is sadly neglected, while facial casts are rarely if ever attempted. There is nothing more needful in the correction of dento-facial irregularities than perfect facial casts for study and comparison, and in determining the real character of the facial inharmony. Nothing will give greater satisfaction than to be able thus to watch and show the different stages of progress in an operation. The changes are so gradual and usually without special physical or mental disturbance, that those who are most interested in the work are hardly able to appreciate the improvement until brought face to face with the original conditions. They are useful, also, to show and explain to others who contemplate operations. They are invaluable, moreover, as a means of general study, for the cultivation of the esthetic senses, and especially in the teaching of the higher branches of the art to students.

Their principal value lies in the advantage of having always at hand the original facial inharmony which can be quietly studied, in viewing it from every angle, to determine the changes which should be or have been made in the course of the operation.

In this particular they are far superior and more exact than photographs that give only one or two flat views, which may be inadvertently distorted; a contingency (as will be seen in following the directions for taking the impressions) that is next to an impossibility with the facial casts. Considerable space is therefore given to facial impressions and casts with the hope that this important branch of the work will be more thoroughly taught in colleges.

Stock Material. —The requirement that students shall roll and prepare banding material has been abandoned because of the meagre facilities in colleges for properly performing the work, and principally because they will rarely prepare it in practice. The same is true of a large proportion of other material, such as

wire and tubing which should be furnished in exact sizes, to be used in the construction of appliances and the complete apparatus in the infirmary practice.

The wire and part of the tubing they draw will train them in the use of the draw-plate; though it can hardly be considered as belonging to the stock, because, unless the wire is drawn through a specially prepared draw-plate, in all probability it will not be the proper size for threading in the screw-plate, and moreover it would require the frequent use of a micrometer gauge, which students will not purchase, to determine and classify the sizes.

Bands.— Believing that students should be thoroughly trained in the construction of different kinds of regulating bands, fully finished with attachments, that they may be called upon to construct for the regulation of teeth, the technic branch of this work contains the most practical bands that are used for different apparatus, with full illustrations and descriptions of each. The teacher is expected to select from the bands shown in Chapter V the kinds which he wishes his class to construct, requiring each student to make at least twelve creditable bands for different teeth. He should make enlarged working drawings of these in the form of laboratory charts, which may be consulted during the progress of the work.

The large number of bands which are illustrated and described in Chapter V include all of the bands which are employed in the practical construction of regulating apparatus in Parts IV and V of this work. A single chapter has been given to describing their construction in detail, for the purpose of avoiding the necessity of much repetition in the text description of practical methods of regulating.

Band Measurements. — I would advise that students be required to take the band measurements of the **natural** teeth of the fellow who is chosen for the impressions. In cases where this is not possible a technic rubber model can be substituted. The practical advantage to the students over the ordinary way of allowing them to take the measurements and fit the bands to the plaster models or dummies is quite as marked as the practical advantage of infirmary work over that of the technic in other departments, and it is especially desirable in this department in which students cannot always be supplied with practical cases. Occasionally a student will object to having the measurements of his teeth taken, claiming that separating will injure them; but those who have the slightest interest in the advancement of their fellows or themselves will willingly submit to the unpleasantness, for that is all it amounts to.

Taps, Nuts, and Wire.—The threading and finishing of blank taps, nuts, and wires that are furnished to the class in accurate sizes, and the construction of a few kinds of jack and traction screws, will give to the student all the training necessary in this line.

Advantages of the Training.— Instead of requiring students to construct the usual stereotyped regulating apparatus, with training limited to the demands of a few simple characters, appliances are now constructed by the entire class with

training distributed so as to apply to a large proportion of all characters of irregularity.

If the work is pursued as it should be along purely practical lines, it will offer to the student a far more thorough system of training for final practice, with fewer difficulties and less time expended, than has been possible under a régime that requires the complete construction of implements and appliances, and a final "show-up" apparatus, from the crude material.

Standard Sizes

True success in teaching every branch of Orthodontia which pertains to the construction and action of appliances, whether in practical or didactic instruction, will never be attained without the adoption of some standard system of sizes and the use of a screw-plate that will properly thread the few sizes of wire we require for the work. Then a large proportion of the auxiliaries which we use, or wish to refer to in our teaching, can be numbered the same as the wire for which they are constructed to fit or aid in the fittings of.

In a paper presented at the meeting of the Institute of Dental Pedagogics in 1899 this principle of teaching was advocated, and I am pleased to say that it is one that is now made absolutely practical by the use of the new Standard Screw-plate. Heretofore we have been obliged to draw wires that could be properly threaded in the screw-plates that students would purchase, the most popular of which has been the "Martin." And as most of the sizes of the screw-cutting holes in these plates are either a few thousandths of an inch too large or too small to properly thread standard sizes of wire, students and dentists who attempted to make regulating appliances were obliged to redraw commercial wire through a specially prepared draw-plate that was adapted to the requirements of the screw-plate or screw-dies which they happened to possess. In college work this required the use of an expensive micrometer gauge and a perfect knowledge of the exact sizes they required; a process that could only be determined by the skill of an expert for each of the various kinds of plates in the class, besides many other difficult and almost insurmountable complications.

In the teaching which is now proposed and presented in this work, the sizes or thickness of wire, blank taps, plate, banding material, and the wall thickness of tubing will be recognized as the American (B & S) Standard gauge sizes; whereas tubing, screw-plate holes, taps, blank nuts, nuts, and wrenches will take their size numbers from the respective sizes of wire they are intended to be used with. For instance: a No. 18 wire can be perfectly threaded in a No. 18 hole of the Standard Screw-plate; a No. 18 blank tap can be threaded in the same hole to make a No. 18 tap with which a No. 18 blank nut can be threaded to make a No. 18 nut, etc.

When it becomes necessary to speak of any of the above material, either in our teaching or in ordering stock, etc., the mere mention of name and number conveys

at once an intelligent idea. Students soon become familiar with the few sizes required for the different appliances, and have a far more intelligent appreciation of the work in its several branches.

Recitation Teaching

"It is the belief of many experienced teachers that we will never arrive at the perfect teaching of orthopedic dentistry until text-books are written relative to the practical principles and methods of regulating that will enable us to present this portion of the teaching in the form of **recitations**, instead of the usual stereotyped lectures.

"With the latter method the student comes to the class usually with no knowledge of the subject that is to be presented; and when he leaves he is more often than otherwise in a mystified state of mind, so that the little knowledge he has gained will not stay with him long; and as it is impossible for more than a few students to take intelligible notes of what has to be taught with blackboard drawings, charts, and lantern slides relative to the various forms of irregularities and the construction and application of methods for their correction, the final result of our work on the candidate for graduation is something upon which we too often are obliged to simply close our eyes.

"With the method proposed, the student would be able to come to the class fully prepared to answer all questions relative to the character or characters of irregularity and their treatment that are selected for the hour, illustrations of which are thrown upon the screen.

"If these are presented in a perfect sequence of arrangement, properly grouped and classified, the student is kept in intelligent touch with the teaching from the beginning to the end of the course.

"During the progress of this portion of the course, the teacher can amplify the work with his individual experience in similar cases, or the methods of others which he believes to be more practical, and other knowledge of importance not mentioned in the text." *

"With those irregularities that are susceptible of being classified, the student should have an opportunity to study the general characteristics of each class as compared to other classes, and the distinguishing features of the types of each class as compared to other types of the class, that he may learn to recognize them and thus be able to apply the proper treatment for their correction. In this study there should be presented to his mind the probable causes which may have operated in its production; the advisable treatment, and the character of movements that should be employed and why; the appliances which are applicable; the character and direction of force the appliances are calculated to exert; and every detail to fit him for subsequent demands.

"He will then be enabled to come to the **recitation** or quiz, not only prepared and in touch with the work of the hour, but with a knowledge of far more than the

* From a paper read before the Institute of Dental Pedagogics, January, 1904.

time of a lecture would permit giving; and, in fact, much more than can be touched upon in the quiz. The teacher can then drive home the most important principles, and those portions of the work which this intimate touch with the class will enable him to see that they do not fully grasp, with the assurance that it is being received by minds which are intelligently prepared to appreciate it.

"The **questions** which may be asked in the **recitation** pertaining to the work should be carefully and systematically prepared by the teacher, so as to bring out all the important propositions, and especially the distinguishing features of diagnosis and treatment. If given to the class in advance, these questions will be of the greatest aid in a study of the subject, sharply calling attention to that which they should fully understand. In this connection I may say it is my intention to prepare a booklet of questions, with chapter and subheading titles in accord with the work, with blank pages which will enable the student to make a ready reference **compend**."*

A Practical Test

By furnishing to my students advance-sheets of this book, commencing with Part V, I was able to give the method of **recitation-teaching** a practical test of two months duration before going to press with this chapter, which was held back until the last form to enable me to publish with this edition an opinion of this trial. In view of the results obtained, I am pleased to say it is fully equal to my highest expectations, and that nothing could now induce me to go back to the old system of simply delivering lectures upon subjects of which the students are supposed to know little or nothing in advance. Moreover, it is the unanimous expression of my students that this is the only intelligible way in which the higher principles of the art of regulating teeth can be taught. One would soon understand this on seeing the interest, intelligence, and enthusiasm expressed by them at these hours when we gather together to discuss the intricate questions of dento-facial irregularities, their causes, diagnosis, and treatment. At these times the different characters and types are exhaustively examined and compared, together with the methods and appliances best calculated for their correction.

NOMENCLATURE

A correct use of terms that may be universally adopted is greatly to be desired in this department of dentistry. At present we are hampered by the use of wrong or ill-chosen terms which we are often constrained to cling to because of general usage. Again, we are unhappily mystified by the ill-advised use of terms which prominent writers have from time to time adopted in their efforts to find words that would more clearly and concisely express their meaning, and perhaps also to simplify that which should be more specifically and scientifically defined.

*From a paper entitled Recitation Teaching in Orthodontia, read before the Institute of Dental Pedagogics, January, 1908.

At the last meeting of the International Dental Congress at Paris, I was pleased to see that the terms "Orthopedie Dentaire" and "Orthopedie Dento-Faciale" were the only terms used in French to indicate the department which we commonly call Orthodontia. In a paper presented before the Odontological Society of New York City, March 19, 1895, I expressed my views upon the use of this term as follows:

"The term 'Orthodontia' is not sufficient in itself because its meaning is limited to irregularities of the teeth and their correction; whereas a movement of other parts, quite as important in the reduction of certain facial deformities as the movement of the teeth, has long been recognized as within the possibilities of dental force appliances. And as this branch of science is becoming more and more an important factor under the influence of modern methods, I would suggest as a more comprehensive and applicable title the term 'Dental Orthopedia.'"

The word "Orthopedia" is derived from two Greek words which literally translated mean "straight child." Originally the word was chosen to indicate that branch of general surgery which has for its object the straightening or correcting deformities of children by the moderate application of force to the undeveloped and yielding bones. Orthopedic surgery in its present and broader sense includes the correction of all deformities accomplished in a similar manner. "Orthopedic Dentistry," or "Dental Orthopedia," therefore would plainly specialize the art to the correction of all dental and facial deformities accomplished by orthopedic movements of the teeth and connecting bones.

The selection of the word "Orthodontia" to indicate that branch of dentistry which has for its object the correction of malposed or irregular teeth was unfortunate, because the word means in the Greek "straight tooth." We do not straighten or correct the shape of an individual tooth as the orthopedic surgeon corrects the form and shape of a child, but we correct its position. The choice, however, was excusable as long as the art was confined to the correction of dental arch alignment and occlusion; but now that one of the principal accomplishments of the art is to correct facial deformities through the medium of force applied to the teeth, I have felt constrained to use a term whose meaning is better adapted to this broader scope of the art. However, as without doubt the term Orthodontia will always continue to be used in reference to the correction of occlusion and arch alignment, and as I do not wish to appear pedantic, it will be found that I freely use the term in its restricted sense.

The following terms as defined will be used in this work as the standard expressions in this department of dentistry.

Dento-facial Area is the facial area which is supported and characterized by the teeth and the alveolar process.

Dento-facial Relation refers to the relation which the teeth in occlusion bear to the physiognomy. In **normal dento-facial relations**, or **dento-facial harmony**, the

teeth and overlying features are in the most perfect harmony to the general facial outlines.

Naso-labial Folds, Depressions, or Lines extend from the lateral borders of the wings of the nose diagonally downward to a point slightly below the corners of the mouth, marked by the action of the orbicularis oris and risorius muscles.

Labio-mental Curve or Depression is the concave depression beneath the lower lip and above the chin.

Irregularity.—The terms "irregular" and "irregularity," when used in reference to the position of the teeth, mean that the said teeth are not in the regular or established anatomical relations. Teeth are irregular when they are (1) not in normal alignment; (2) not in normal occlusion; and (3) not in dento-facial harmony. Teeth may be in normal alignment and irregular because they are in malocclusion — the upper or lower denture being protruded or retruded. Again, teeth may be in normal alignment and in normal occlusion, and irregular because both the upper and lower dentures are protruded or retruded in their dento-facial relations.

Posed and Malposed.— Teeth are **normally posed** when regular or in normal positions. The terms "**malposed**" and "**malposition**" are used with varying shades of distinction as synonymous with **irregular** and **irregularity.**

Alignment and Malalignment.— Teeth are in alignment when they are in proper relation to the line of their dental arch. A tooth or teeth in malalignment constitute an irregularity, yet all the teeth of the dental arch may be in perfect alignment and also irregular as instanced by abnormal protrusions of the upper and other conditions.

Occlusal Relation refers to the relation in position which the upper and lower teeth bear to each other.

Occlusion refers to the closure of the teeth one upon the other. There has been a recent effort, among a certain class of orthodontists, to make the word "occlusion" stand for a far wider scope of meaning than any of the lexicographers would think of claiming for the word. The claim is: that when the jaws are in masticating closure it is improper to say that the teeth are in "occlusion," unless they close in absolute **normal occlusion.** And further: it is improper to say that teeth are in "normal occlusion" unless the facial outlines, supported by the teeth and alveolar arches, are in absolute **dento-facial harmony.** This rather amusing attempt seems to be for the purpose of making the word "malocclusion" properly apply to all irregularities of the teeth.

Normal Occlusion, Typical Occlusion, and **Normal Dental Relations** refer to the established anatomical or standard occlusion. The word "**normal**" means "according to rule," or "that which is in conformity to natural law." It would seem that its meaning is not as definitely symbolical of an exact condition or position as "typical," though the difference is quite like splitting hairs. In reference to

occlusion, **normal** is a useful word because slight variations from the typically anatomical is "the rule" rather than the exception, as is well shown by the difficulty which some authors find in an endeavor to find a perfect illustrative specimen of what they are pleased to term "normal occlusion," but which, per se, is an ideal anatomical occlusion.

In the usual masticating closure of the buccal teeth that are not in malocclusion, the cusps of one denture strike well within the anatomically intended spheres of their opposing sulci and depressions, but not necessarily in absolute typical form, and yet it is that which may be correctly termed a "normal occlusion," because it is according to rule. (See Chapter XII.)

When the occlusion of one or more teeth varies from the normal to a degree that materially interferes with their function of mastication, and also when the points of the cusps are completely outside their normal interdigitating spheres and possibly in full malinterdigitation, they are in **malocclusion** and of course irregular. But the term "**malocclusion**" refers to only one phase of irregularity, as the teeth in **normal occlusion** may also be quite irregular or in malposition in relation to dento-facial harmony, as instanced by bimaxillary protrusions and retrusions.

Malocclusion, therefore, should be used only in referring to teeth which do not close according to anatomical rule, as opposed to **normal occlusion.**

Interdigitate and **Interdigitation** have reference to any closure of the buccal teeth in which the cusps of one denture strike fairly into the occluding sulci of the other, as opposed to that which is sometimes called an "end-to-end occlusion."

When the teeth are in normal occlusion the buccal cusps are in **normal interdigitation.**

Malinterdigitation.— When the buccal cusps fairly interdigitate with the teeth in abnormal occlusion,— as in upper protrusions, for instance, where the upper buccal cusps are fully the width of a bicuspid in front of a normal occlusion with the lower — the cusps are in abnormal interdigitation or "**malinterdigitation.**"

Open Bite Malocclusion.— When upon occlusion of the back teeth the front or "biting" teeth do not come together, leaving a space of more or less width between, the irregularity may be properly termed an "open bite malocclusion." See p. 358.

Close Bite Malocclusion.—The contrary condition of the above would, therefore, apply to those cases in which a closure of the back teeth causes the front teeth to pass their normal occlusal planes, frequently forcing the lower incisors deeply into the gum back of the upper front teeth. See p. 319.

Short Bite Malocclusion.— When all of the teeth — both back and front — are too short in relation to the normal occlusal plane, or to a plane in line with the normal closure of the lips, the irregularity is spoken of in this work as a "short bite malocclusion." It is characterized by a great redundancy of labial and buccal tissue. See p. 322.

Long Bite Malocclusion would be the contrary position, with all of the teeth

too long in relation to the normal occlusal plane, and characterized by elongated features, abnormal exposure of the teeth in talking, difficulty in closing the lips, etc.

Mesial and **Distal,** when used to define malpositions, occlusion, movements, etc., will be used only in the sense in which they were originally intended to be used in dentistry, i. e., toward or from the medium line in a direction along the curve of the dental arch. Therefore they should not be used as they frequently are in the sense of anterior and posterior, front or back, or protruded and retruded. For instance, if "the lower first molars occlude mesially to normal in their relation to the uppers," this irregularity should not be defined as one "in mesial malocclusion" without other qualifications, because **occlusion** is a word which has reference to the upper teeth as well as to the lower in occlusal contact, therefore the irregularity might as well be defined as one in distal malocclusion. Again, the mesio-distal relation of the molar occlusion in no sense defines the real irregularity because this relation does not necessarily indicate that the lower or the upper teeth are protruded or retruded, as the fault may be entirely with either denture alone; or it may be partly with the lower and partly with the upper denture. The character of an irregularity which is due to an antero-posterior malrelation of the upper and lower teeth, should be defined according to the facial inharmony it produces.

Arch.— The dental arch is that inscribed by the teeth. The **alveolar arch,** that inscribed by the alveolar process and overlying gum. The **dome** of the oral arch refers to the roof of the mouth.

Zone is a favorable word for locating sections of the dental and alveolar arches that we frequently wish to refer to in describing different characters of general malpositions and movements. **Dental zones** may be considered as narrow areas extending along the dental arch parallel to the occlusal plane as **Occlusal, Gingival, and Apical Zones.** (For "Dento-Facial Zones" see Chapter XV.)

Malturned is used in reference to a tooth so turned on its central axis as to stand in malposition. The term "malturned," though somewhat of a mongrel, is much to be preferred to "torsion" and "torso-occlusion," because a tooth is never in a twisted position nor do we twist teeth as we do a string or any yielding substance. We rotate them on their central axes.

Rotate, etc., is used in reference to the **process** of turning a tooth. Many authors have heretofore used "rotate" and its suffixes to define both position and action. The same is true of "torsion." The author finds that it avoids much confusion in teaching and writing — besides being more proper — to use distinct words for position and action.

Compound Terms. The adjectives **mesial, distal, labial, buccal, lingual,** and **occlusal,** and their combinations can be happily used to exactly define certain malpositions, movements, points of attachment, direction, etc. The direction in which a tooth is malturned or requires rotating on its central axis may thus be fully defined with a compound word, if it is understood as in other departments

that the first member of the compound word indicates the location upon the surface of the tooth, and the last member the direction of the movement. For instance, we may say that a central incisor is malturned labio-distally, or that it requires the application of labio-mesial rotating force. Again, it may be in mesial, distal, labial, buccal, or lingual inclination, or in labial or lingual malalignment, etc.

Anterior and **Posterior** are words that are so well established by common usage, it would be difficult if not impossible to drop them from our nomenclature even if we wished. When used to define relative position or movement in a direction parallel to the median line of the dome, they are frequently of great advantage.

Protrude, Retrude, etc.—The syllable "trude" (from trudo, to thrust) with certain prefixes, as pro (forward), re (back), ex (out from), in (into), con (in upon), gives us a class of words of distinct and scientific meanings. Teeth are **protruded** or **retruded** only in respect to their normal dento-facial lines, and in no instance can this be determined or defined by the occlusal relations, as some writers imply.

Extrude and **Intrude** apply to teeth which are not in proper relation to the line of a normal occlusal plane, and commonly spoken of as teeth that are too long or too short. The terms will be used particularly to define malpositions of one or more teeth whose occlusal surfaces or incisal edges are not normally even with those of their adjoining fellows. When the condition involves all of the front teeth, it will of course constitute an "open" or "close bite" irregularity, though correction may be properly defined as the partial intrusion or extrusion of these teeth.

Contrude is a handy word, not supplied by any other, to indicate an abnormal inward curve of any portion of the line of the dental arch. Thus, in a "club shaped arch," the sides are contruded. It may also be used to refer to a single tooth which is crowded lingually into malalignment.

The term in geology refers to a downward or inward curve of the line of strata, due to the pressing in together of its particles.

Labial and Buccal Teeth.—It is frequently desirable to speak of the six front upper or lower teeth as having moved or requiring movement in phalanx. The same is true of the right and left upper and lower side teeth. Therefore the term "**Labial Teeth**" will be used to refer to the incisors and cuspids in single phalanx; and "**Buccal Teeth**" to the bicuspids and molars in single phalanx.

Front, Back, Upper, and Lower.—In referring to the general location of the teeth, the terms "**Front**" and "**Back**" will be used in preference to the terms "**Anterior**" and "**Posterior**"; and the terms "**Upper**" and "**Lower**" teeth instead of "**Superior**" and "**Inferior**" teeth.

In this work the terms **Cuspid** and **Canine** will be used synonymously, though preference is given to the former. **Bicuspid** and **Deciduous Molar** instead of "Premolar." **First Permanent Molar** instead of "Six Year Molar." **Third Molar** instead of "Wisdom Tooth."

In the present unfixed state of our dental nomenclature the author believes it inadvisable to wholly discard the use of any one of two or more terms which by long usage and strict scientific application refer to the same object, and especially those which are correctly employed by our best writers.

The term "Cuspid" instead of "Canine" is the choice of Dr. G. V. Black in our leading Dental Anatomy. In a letter in reference to these terms he says:

"I wish to say this: that Dental Nomenclature in dentistry is not necessarily dental nomenclature in comparative dental anatomy. The comparative dental anatomist's nomenclature never will answer the purpose of the dentist, and neither will the nomenclature of the dentist answer the purpose of the comparative dental anatomist, and the quicker this is recognized the better it will be for all parties. We do not write of dog's teeth and we have no use for the term 'canine tooth.'"

The author does not object nor refrain from using any advisedly established term which is applicable and calculated to convey the desired meaning. The term "Canine" has come into quite general use of late and the fact that it is wholly adopted by the Cosmos and a number of leading dental journals and text-books, are good reasons for adopting it in this work, but it seems unreasonable to drop "Cuspid" as long as we retain "Bicuspid." The two words, as a pair, are plainly indicative:— the one referring to a tooth having one cusp and the other to that having two cusps.

The term "Premolar," when referring to the bicuspids, is objectionable, because if there are any teeth in the mouth which are premolars according to the strictest meaning of the term, **they are the deciduous molars,** as these are the only other teeth which in form and function are like the permanent molars, and they are also "pre" to the permanent molars both as to position and time. Dr. Cryer rightfully calls them premolars, though he also uses this term in referring to the bicuspids; while others confine the term to the bicuspids alone. Therefore the use of the term "premolar" leads to confusion in the expression of ideas and should be dropped from our nomenclature, especially when referring to the bicuspids.

Cast.—The author prefers the term "**cast**" to "**model**" in reference to anything which is made by pouring a crystallizable substance such as plaster or metal into an impression or mould. **Model** is indicative of an object which is employed, modeled, or fashioned as a pattern for duplication. As the latter term however has been quite extensively used by our best writers in referring to plaster casts of the teeth, etc., its use will not be wholly dropped in this work as a synonym.

Unilateral, indicating location, refers to one side of the mouth.

Bilateral, indicating location, refers to both sides of the mouth.

Unimaxillary, indicating location, refers to one jaw.

Bimaxillary, indicating location, refers to both jaws.

PART I

Technics of Dental Orthopedia

DENTAL ORTHOPEDIA

CHAPTER I

TECHNIC PREPARATION OF STOCK MATERIAL AND IMPLEMENTS

Wire, Tubing, Screws, Taps, Nuts, Drills, Intermaxillary Hooks, Sliding Tubes, Wrenches, Tape, Band Material, and Solder

The Stock Material

The material which is quite universally employed in the main for regulating appliances is German silver. Great credit is due to Dr. Edward H. Angle for its application. It possesses all of the requisite qualities of gold and its alloys for the temporary purposes of the appliances, except that of appearance; and even this may be overcome by a skillful construction, high finish, and heavy gold plating, followed by keeping the appliances clean and polished. One of its great advantages over gold lies in the fact that dentists are more willing to remove and throw away German silver appliances as soon as they have outgrown their usefulness, and exchange them for others which are more perfectly adapted to meet the demands of changed conditions. However in all special cases in the author's practice the labial bands and attachments are made of platinized gold, as are all retaining appliances.

ROUND WIRE AND ITS PREPARATION

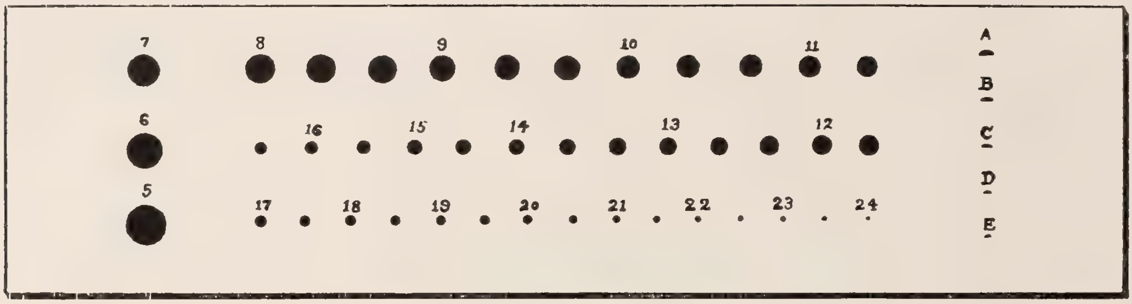
Nearly all of the German silver wire employed for regulating appliances should be drawn as hard as possible, so as to possess sufficient thread strength, rigidity, resiliency, etc. As the smallest wires require these qualities to the fullest extent it is advisable to draw all wires from larger sizes of "extra hard" commercial wire, and without annealing.

Any round-hole **draw-plate** that has a sufficient range of sizes can be prepared by enlarging the holes that are slightly too small for the required sizes with a fine emery strip rolled in the form of a string. If any of the holes require to be enlarged considerably, the approaching holes should be graduated in size. This work demands careful manipulation, as the difference of the thousandth of an inch on a fine screw thread is considerable. Therefore frequent trials by drawing the wire through and measuring it with a **micrometer gauge** is advisable. As this process requires considerable skill and special instruments for determining the

exact sizes required, it may be omitted from the class requirements by using specially prepared wires of standard sizes which can be threaded in the Standard Screw-plate.

At the meeting of the Institute of Dental Pedagogics in 1899, the author presented a dental draw-plate, the holes of which were to be accurately constructed to draw the standard sizes of wire that we require. But after several futile attempts to have this manufactured, both in Europe and in this country, it was abandoned, as absolute perfection in the required sizes of the holes was not attained on account of the uneven contraction of the steel plates.

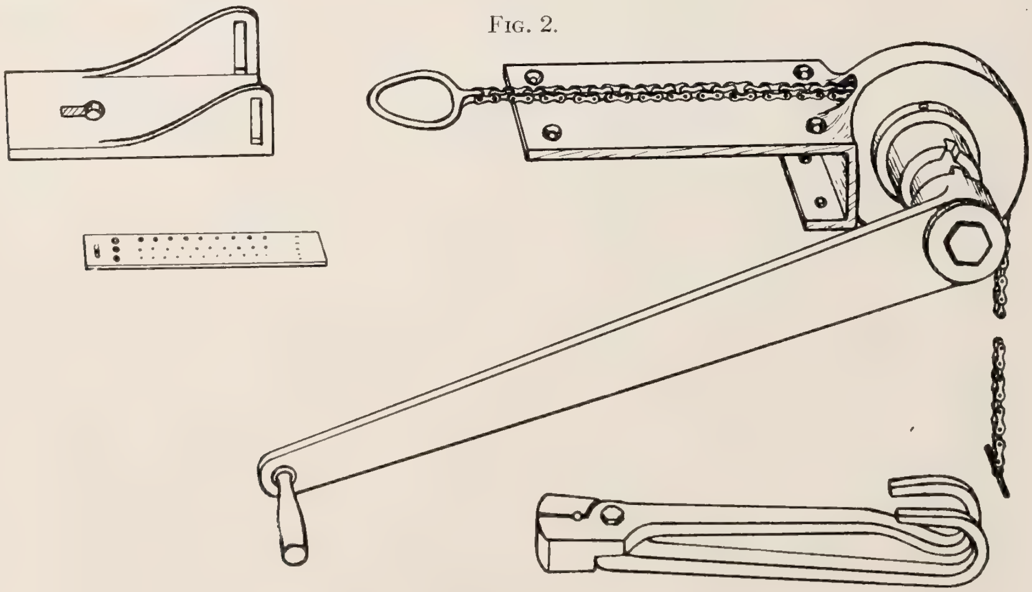
Fig. 1.



Draw-Plate.

The only **draw-plate** at present in the market which is adapted for drawing both wire and tubing is the one which the author introduced in 1892, and first furnished through Knight & Co., of Chicago. It differs from other draw-plates in that it has three large holes at one end for starting tubing. The holes of this, as with the ordinary plates, will require to be prepared for the Standard sizes. Another **plate** to be placed on the market is shown in Fig. 1. There has been an endeavor to make the numbered holes the Standard sizes. Also to provide holes for drawing the special hook wire.

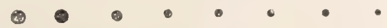
Fig. 2.



Draw Machine.

A **draw-bench** is indispensable for college work and all extensive drawing of wire and tubing. The machine shown in Fig. 2 was introduced by Dr. John Stephan, of Cleveland, Ohio, the general plan of which was drawn from one made and used by the author. It essentially consists of a **draw-plate-holder** at one end and at the other a finely constructed steel **ratchet windlass** for supporting the attachment of a **bicycle chain,** to which is attached the **draw-tongs.** The wire to be drawn should be tapered at one end to pass through the required reducing hole of the draw-plate to be grasped by the draw-tongs. Before commencing the operation see that the plate is well oiled.

Nos. *13 14 16 18 19 20 22 23*



Sizes of Round Wire.

In an extensive practice of Orthodontia, the following sizes of round wire will be found useful: ***No. 13** Standard American gauge (.072 Micrometer Gauge) is the largest size required, and is used for Power Bows for protruding the roots of front teeth. (See ****Aps. 84 and 87.**)

No. 14 (.064) for Power-Bows (**Ap. 82**), Drop and Curved Jacks (**Ap. 45**), Reciprocating Expanding Jacks (**Aps. 53 and 54**), Expanding and Contracting Spring Bows, etc. (**Aps. 44 and 55**).

No. 16 (.051) for Jacks of all kinds, Expanding and Contracting Bows, etc., (**Ap. 18**).

No. 18 (.04) for small Jacks, Traction Bows, Bars, etc.

No. 19 (.036) for Traction Jacks and Bars, Traction and Alignment Bows, etc.

No. 20 (.032) for Traction and Alignment Bows.

Nos. 22 and 23 (.025 and .0225) Alignment and Traction Bows, Rotating Bars.

Of these sizes, Nos. 16, 18, and 22 are sufficient for college technic work.

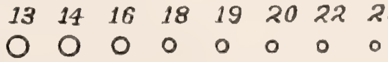
HOOK AND REINFORCEMENT WIRE

Nos. *13 16 19*

The most favorable form of wire to be used for **hook attachments** to bands, and for extension arms to rest upon adjoining teeth, or to unite bands in the construction of stationary anchorages, has been found to be similar to that of flattened D wire with the corners rounded. It comes in three sizes, Nos. 13, 16, and 19. The numbers which represent the sizes are according to the greatest diameter.

ROUND TUBING

Nos. *13 14 16 18 19 20 22 23*



German silver **Seam Tubing** is drawn from strips of plate cut the proper width and thoroughly annealed. Use No. 28 for anchorage tubes (See ***B. 75**, etc.); No.

* In this work the abbreviation "No" placed before a numeral will be understood, when not otherwise defined, as referring to the "Standard American (B. & S.) Gauge" sizes.

** Ap. Apparatus or appliance.

* B. Band.

30 for traction tubes on front teeth (**B. 40**, etc.); and Nos. 32 and 34 for rotating tubes (**B. 13**).

To facilitate starting the drawing of the tube, lay the strip lengthwise over a groove cut in the end of a piece of hard wood, and drive it in with a round wire follower about the size of a lead pencil. Then taper one end with the shears and fold it to a solid entering and grasping point.

See that the draw-plate holes are well oiled and commence with the large hole, No. 5, at the end of the dental draw-plate, Fig. 1, through which it can be easily drawn, gradually diminishing the size and with occasional annealings untii the tube loosely fits the largest of the required wires. Cut off the needed amount and proceed with the balance for the smaller sizes.

The **Rotating Tubing** can be drawn from banding material, Nos. 32 or 34. It is made thin so that the bar will hug the tooth and leave no projecting edges. It will be found advisable to use the prepared seamless, rotating tube, as students will experience considerable difficulty in preventing the solder from flowing through the seam into and filling small tube attachments.

In practice, the author considers it quite important that the different tubes vary in wall thickness according to size and the object for which they are employed.

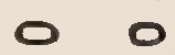
Seamless Nickel Silver Tubing is the best except when gold is demanded, and can be procured any size of wall thickness; as can all other classified material for attachments, etc.

Two numbers are necessary to denote the size and wall thickness of tubing. The first indicates the size of the wire it fits and the second that of the wall. Thus, a No. 22-32 rotating tube is drawn to closely fit a No. 22 rotating bar or wire, and its wall thickness is No. 32.

Tubing that is used as a resistance to the action of a nut, as anchorages and jack tubes, should possess a wall thickness somewhat in proportion to the external size of the nut, so that the corners of the latter will project as little as possible.

ELLIPTICAL TUBING

Nos. ***16*** ***19***



Elliptical Tubing for **jack-rest attachments** (**B. 23, Ap. 16**) can be made by passing round tubing Nos. 16 or 18 through the rollers, or it can be purchased accurately drawn to any required size.

OPEN TUBING

Nos. ***16*** ***18*** ***19*** ***20***

Open Tubing (**Bs. 4, 30**, etc.) for alignment or traction arch **bow rests** can be made by opening round **seam tubing** drawn to tightly fit the required bow, using

a No. 30 wall thickness, or it can be purchased accurately drawn to any required size.

The tubes are cut the proper length and then soldered to the bands with the joint relatively outward, after which they are opened with a tube mandrel to the appropriate size.

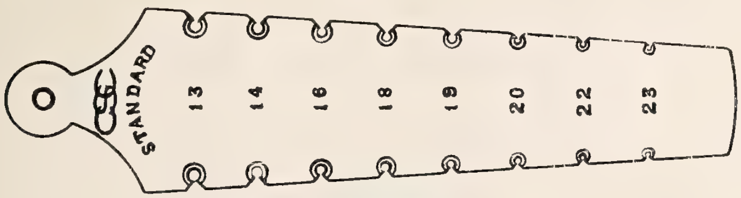
SCREWS

The **Standard Screw-plate** (Fig. 3) is constructed especially for threading all of the standard sizes of wire required for Orthodontia work.

German silver wire is perfectly threaded with this **plate** by rapidly revolving the wire, grasped by a chuck, in a jeweler's lathe, as follows:—Taper the end of the wire slightly to a starting point and sharpen the screw-cutting threads of the plate by running a three-cornered Arkansas stone in the V-shaped clearing slots made for this purpose. See that the desired hole is well oiled and then run the lathe at any rapidity. The counter thread will usually come away in a long clean-cut curl.

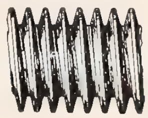
The ideal screw which we strive to obtain in the construction of regulating appliances has its threads deeply and sharply cut, shown in Figure 4, which, with wires and nuts properly threaded is impossible to strip even with sizes as small as No. 23, and what is of equal importance, a screw of this character, fitted with a properly threaded nut, does not require a lock-nut to prevent it, when under the slightest stress, from unscrewing.

Fig. 3.



Screw-plate.

Fig. 4.



The sizes of wire and blank taps should be the largest diameter of the screw-cutting holes that are designed to thread them, providing the **screw-plate** or **screw-dies** are properly constructed to cut the counter thread out, instead of mashing the material to the height of the screw-thread, as is common with ordinary screw-plates. Again if the wire, and especially the blank tap, is not the full required diameter, the thread will not be full height, and what is worse, deceptive friable furrows will top the borders of its crest, which with the smaller screws can be discerned only by high magnifying powers. If one wishes to be convinced of this he should examine with a 2-in. microscope lens some of the arch-bows which are commonly made with ordinary screw-plates or dies.

In college work the wire can be grasped in an ordinary pin vise. The screw-plate should always be held somewhat loosely in the hand, and not in a bench vise, to allow the wire to guide the plate to the proper angle. This especially applies

with the threading of steel taps, which frequently break for no other reason than the attempt to hold them, or the screw-plate, immovably in a bench vise.

TAPS

Blank Taps (Fig. 5) are preferably made of engine-bur steel, with a shank which is accurately turned or filed to the exact size required for threading in the screw-plate, that is employed for threading the wire. In preparing to thread a **tap,** place it in a **pin vise** and draw the temper by bringing it to a red (not white) heat, allowing it to cool slowly. Taper the end to an entering shape and see that the **plate** is well oiled.

Fig. 5.

In cutting the thread make a to-and-fro torsion movement of the **pin vise**. If dangerous force seems to be required, see that the blank tap is not larger than the standard size required, measured with a **micrometer gauge.**

Fig. 6.

The full threaded portion of a **tap** as shown in Fig. 6 need not be more than ¼ of an inch long. After threading, file the end three-cornered or flattened, and after tempering, sharpen the facets on an oil stone. When finished **blank nuts** are not employed, one end of the **tap** may be constructed as shown for finishing the **nuts.**

Tempering

In tempering a **tap** or any small steel instrument, grasp it with pliers in one hand and with a small cup of water in the other, pass the instrument into the blaze of a Bunsen Burner, directing the heat first to the shank. When it begins to turn red, commence a to-and-fro movement in drawing the red color out to the point. With this motion you can easily keep in touch with the color, and evenly distribute it where desired, thus avoiding the danger of carrying it beyond a light cherry red that might burn the steel, though it should be carried to the limit. The motion also will facilitate a quick plunge of the instrument into the water or oil at the very instant it is right. Then try it with a fine file to see if it is as hard as glass; otherwise repeat the operation.

In drawing the temper, polish the shank with a piece of fine emery paper, being careful to avoid cutting the threads; and while grasping the point of the instrument with pliers, in a good light, direct the pointed blaze from a blow-pipe upon the body of the shank, until you see it commence to turn to a straw-color; then with short puffs and close watchfulness, turn the color to a purple and dark blue, verging to a light blue, down to the threads. Now let go the instrument and allow the impetus of the heat to distribute toward the point. If you have polished the facets you will probably see that they turn to a light straw color. In tempering

excavators, the light blue should extend through the smallest portion of the neck and there be made to stop by holding the cutting edge in the grasp of heavy pliers till you can plunge it into water. To obtain the best temper for excavators, the cutting end should never be finished to a knife-blade edge until after the tempering.

While drawing the temper, if uncertain in regard to the color, do not carry it beyond a distinct light blue; but repolish it and again go through with the process of drawing. Redrawing any number of times, if not carried to a higher heat than that indicated by the blue shades, will not soften the steel beyond a spring temper.

Should it happen that over-heating turns the neck of the instrument from the light blue to the light grey, if it is not a large neck, it will probably be too soft, requiring that it be entirely rehardened and tempered.

NUTS

Fig. 7.

In practice three forms of **nuts** are useful, as shown in Fig. 7. They are made by threading accurately turned and bored **nut-blanks**. To assure a perfect fit of the nut to the screw, it should be threaded with a **tap** that is threaded in the same screw-plate which is used to cut the thread upon the wire. Slight differences which arise in the construction of screw-plates that are supposed to be exactly alike, especially if made in different batches, will often mar the smooth turning of a nut that would otherwise closely fit and hug the threads of the screw.

For the most acceptable results in college technic work, square **blank nuts** should be furnished to students with their stock material. **Nuts** may also be made by partially stamping the forms in a nickel with **Nut Dies**. Fig. 8.

Fig. 8.

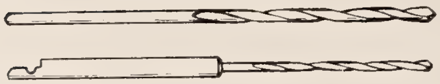
Nut Dies.

Bore and thread the nest stamped with the above **die**, then saw them apart and finish, screwing them on the nut finishing end of the **tap**. All sharp corners should be removed. The partially formed surfaces of the stamped form will guide the student in finishing the nut to a reasonable size and shape, and prevent the frequent exhibition of those large sharp-cornered, often diamond-shaped nuts, from the hands of students.

The hole that is bored for threading should be the exact internal diameter of the screw-cutting hole in which the **tap** is threaded, for the same reasons that apply to the external threading of wires.

DRILLS

Fig. 9.



Twist Drills may be purchased with the screw-plate or otherwise, in properly selected sizes, numbered according to the screw-cutting holes for which they are designed. These can be fitted to dental engine shanks. See Fig. 9.

Fig. 10.

Diamond Pointed Drills may be made from broken engine burs or other blanks, being careful to observe the rules relative to sizes and tempering.

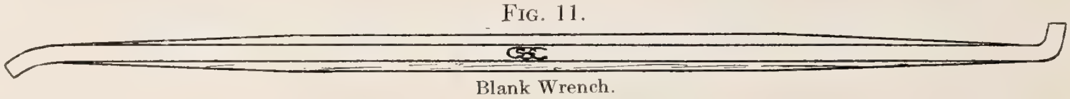
WRENCHES

The external sizes of **nuts** should be somewhat in proportion to the size of the screw for which they are intended, and these sizes should invariably prevail, in order that the **wrenches** constructed or purchased can be numbered accordingly.

To reduce the number of wrenches required to fit the various sizes of nuts, the external sizes of nuts are made in three diameters, as follows: — Nos. 13 and 14; Nos. 16 and 18; Nos. 19, 20, 22 and 23. The last four sizes will permit of the nuts being the same external size. The co-operating **wrenches** bear the indicating numbers.

If the class is required to construct **wrenches**, two sizes will be all that is needed to fit the Nos. 16, 18, and 22 nuts. If the class is divided into alphabetical sections as suggested, but one wrench may be required of each student.

Fig. 11.

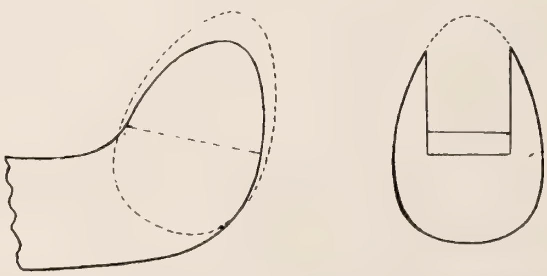


Blank Wrench.

Wrenches for technic training are preferably made from **Blank Wrenches** which are forged the proper size and general shape.

The student should be required to cut the nut-slot the proper size and shape, and finish the jaws and shank. Considering that the jaws should be of sufficient

Fig. 12.

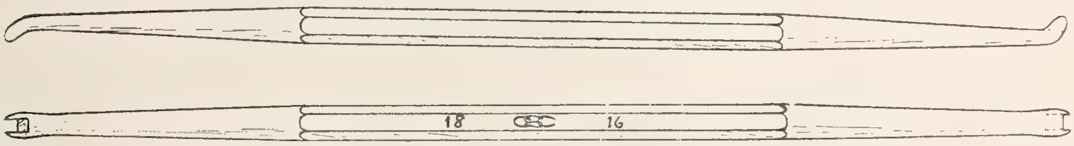


strength and yet contain a minimum amount of material so that they can be placed firmly upon and turn a nut that closely hugs a tooth, they should be given

a rounded taper toward the points, quite the shape of a slice of an egg cut parallel to its long axis, with sufficient body for strength where the jaws leave the neck of the shank, as in Fig. 12.

The **blanks** are forged from $\frac{3}{16}$ inch octagon steel, one end turned nearly to a right angle, and the other at an angle of 45°, and with sufficient length of shaft to reach the most distally located nut and leave grasping place for the hand. Both ends are cut to fit the same sizes of nuts.

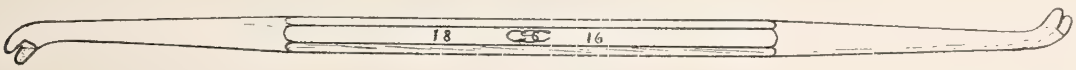
Fig. 13.



Finished Wrench.

In finishing the wrenches no fancy work is permitted on the shanks, but the jaws and slots are required to be perfect in form, size, symmetry, and finish.

Fig. 14.



Twist Wrench.

Twist Wrench.— In practice, a form of right and left wrench, having the jaws slightly twisted in relation to the shank, will be found indispensable for grasping lingually located nuts at a diagonal angle. See Fig. 14.

SEPARATING TAPE

Fig. 15.

Separating Tape.

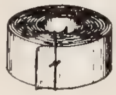
In separating teeth for regulating bands the ideal separator is **Waxed Tape**, (Fig. 15) principally because of the positive and limited degree of its action. Unlike rubber it soon ceases to act with appreciable force, thus giving a minimum amount of pain or discomfort to the patient. In nearly all cases no suffering whatever is produced by its action.

The **tape** is prepared by rolling a skein of German flax tape into a solid wheel, using a wood toothpick for twirling handle. The free end is then secured with a small pin, and the wheel is dipped in boiling white wax and allowed to cool.

It can be procured at dental depots in three properly selected qualities and widths, i. e., Nos. 1, 2, and 3.

BANDS

FIG. 16.



Band Material.

Band Material (Fig. 16) for college work is Nos. 36, 38, and 39, in thickness. The thinner sizes are used for front teeth and all bands where movement is desired; and the thickest for stationary anchorages on molars and bicuspids and wherever long bearing rigidity is demanded.

In practice three widths will be found useful, viz., $\frac{7}{32}$, $\frac{3}{16}$, and $\frac{5}{32}$ of an inch. These should vary in thickness from Nos. 35 to 40 as explained in the details of construction.

Band Material may be prepared by rolling German silver wire to the desired thickness, being careful to commence with a thoroughly annealed piece, and with frequent annealings during the process. Perfect pliability of the material is eminently to be desired to facilitate fitting the band accurately to the tooth. This may be attained by finally holding it at a red heat in a closed muffle, for 15 or 20 minutes. When cool, boil in a weak solution of sulphuric acid and finish on a soft brush wheel with whiting. Rubbing it between pieces of cloth, emery paper, etc., held in one hand injures its pliable quality. The commercially prepared banding material is cut from specially annealed German silver plate.

SOLDER

Silver Solder should be made in large quantities and of chemically pure metals to secure the best results.

Fuse the **copper** first, and when at its lowest fusing point add the **silver** slowly. When thoroughly mixed and with the liquid at its lowest fusing point, add the **zinc** by plunging small pieces at first suddenly beneath the surface. Otherwise a part of the zinc will oxidize before it can unite and become a part of the alloy.

Solder for constructing regulating appliances should be of three grades of fusibility. The highest, or No. 1, for soldering the joints of bands; No. 2 for soldering the attachments to the bands; and No. 3 for occasional use in soldering an extra attachment and in making repairs.

The formulæ which the author has found the best for German silver appliances are as follows:

		No. 1	No. 2	No. 3
Silver Solder	C. P. Silver	8	8	8
	" Copper	4	4	4
	" Zinc	1	2	3

CHAPTER II

STOCK APPLIANCES

Dental Bows, Bars, Jacks, Etc.

Fig. 17.

Alignment and Contraction Arch Bows (Nos. 19, 20, 22, and 23) are threaded at one end only. In placing the bow, the other unthreaded end is annealed and secured in place by bending it forward against the anchorage tube. With wires of the above sizes, traction force applied at one end exerts an evenly distributed tension throughout. See **Ap. 28,** etc.

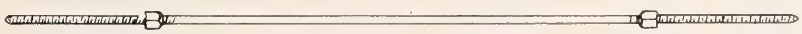
Fig. 18.

Contraction Arch Bows (Nos. 18 and 19, 20 and 22) are threaded at both ends, to be used when greater force is required or when the force of two nuts is desired. For nearly all purposes the smaller sizes are preferable. See **Ap. 82.**

Fig. 19.

Contraction Arch Bows with Cuspid Hexagonal Nuts (Nos. 19 and 20) are for the purpose of producing special retruding strain upon the cuspids through the medium of the cuspid bands. (**B. 34½**). See **Ap. 77.** This form of bow (Fig. 19) is also effective for expanding or contracting the labial arch.

Fig. 20.



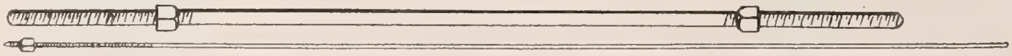
Expansion Arch Bows (Nos. 16, 18, 19, and 20), with nuts placed at the mesial ends of the anchorage tubes, are employed for slightly protruding the labial arch and for general expansion of the dental arch. See **Ap. 68.**

Fig. 21.

Retruding Contour Apparatus Bows (Nos. 16 and 17), the larger of which with nuts at the distal ends of the anchorage tubes is the **power bow** for retruding

the roots of the labial teeth, and the smaller with mesial nuts is the **fulcrum bow.** The fulcrum bow may be No. 16 and at times No. 18. See **Ap. 83.**

Fig. 22.

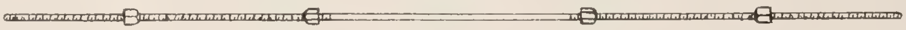


Protruding Contour Power Bows (Nos. 13 and 14) are for protruding the roots of the labial teeth. The **fulcrum bow** is an alignment bow, Nos. 22 or 23, Fig. 17. See **Aps. 84 and 87.**

Fig. 23.

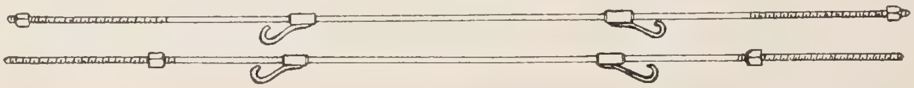
Expansion Arch Bow with Lateral Hexagonal Lug Nut (Nos. 19 and 20) is employed in the apparatus for correcting a unilateral maleruption of cuspid. Instead of the lug nut a lug tube may be soft soldered to the bow at the desired point. See **Ap. 66.**

Fig. 24.



Expansion Arch Bow with Two Lug Nuts (No. 19), the latter to engage with the cuspids for expanding the labial or inter-cuspid arch. See **Aps. 8 and 9.**

Fig. 25.



Contraction and Expansion Arch Bows (Nos. 18, 19, 20, and 22), especially designed for the intermaxillary and occipital force, carry sliding tube hooks for the attachment of the elastic bands to the opposing teeth; and also, when required, short sliding tubes for directing the force upon the molar teeth. See **Ap. 70,** etc.

Fig. 26.

Intermaxillary Hooks are of two forms. That shown on the left of Fig. 26 is the one commonly employed. It is made by soldering to a short seam tube, a No. 19 wire which is bent and finished as shown. The tube should be of the proper size to glide easily upon the bow. The seam opposite the hook permits attaching or removing it after the bow is placed. The form of the hook is especially adapted for the easy attachment and perfect retention of the elastics. It hugs closely to the teeth with no irritating projections.

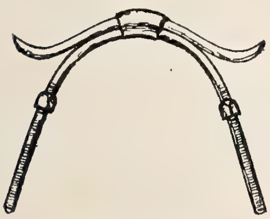
The Span Intermaxillary Hooks shown in Fig. 26 are adapted for spanning the cuspid attachments to communicate the intermaxillary and occipital force (the latter with bow C) directly to the back teeth. They are made by soldering a No. 19 wire to two short seam tubes as shown. See Fig. 23, Chap. XXXVI.

Fig. 27.

Fig. 28.

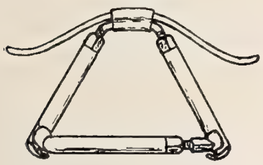
Lingual Expansion Bows (Nos. 18, 19, and 20) are designed to form the protruding bow shown in Fig. 28; the ends to fit into lingual anchorage tube attachments. See **Ap. 15.** It is applicable for exerting a protruding force upon crowded and overlapping incisors where lateral movements for alignment are desired. The reaction of all protruding bows should be utilized for a distal movement of the buccal teeth when demanded.

Fig. 29.



The Yoke Protruding Bow shown in Fig. 29 is designed to exert an evenly distributed pressure upon the front teeth and prevent the lateral incisors from sliding along the bow. The two bows are attached together by fitting the two wires into an elliptical tube which has been made by slightly flattening a round seamless thin tube, by passing it through the rollers. When the wires are in shape the V spaces are closed by pinching the central portion of the tube with blunt cutting pliers. See **Ap. 69,** etc.

Fig. 30.



The Protruding and Expanding Bow shown in Fig. 30 is particularly designed for conditions where, in addition to the protruding and retruding movements, a lateral expansion of the bicuspid area is demanded. See **Ap. 72.**

Fig. 31.

Lingual Expanding and Contracting Bows (Nos. 14 and 16) are well shown in **Aps. 44 and 55.**

Fig. 32.

Pull or Traction Bars (Nos. 18, 19, and 20) are principally used for retruding the cuspids from molar anchorages, and wherever a pull force can be employed through the medium of anchorage tubes or tube attachments. One end is sharply bent to the proper angle to fit the tube attachment. See **Ap. 76,** etc.

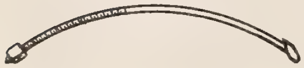
Fig. 33.

Ribbon Attachment Pull Bars (No. 19) are designed especially for rotating purposes, as they can be lapped partly around the tooth and with the presentation of no irritating projections. They form an admirable adjunct to the Reciprocating Jacks. A small hole is punched in the ribbon at the desired point with a plate punch, by which it is attached to the button-attachment. (**Bs. 19 and 35.**) See **Ap. 29.**

Fig. 34.

Push Bars (Nos. 16, 18, and 19) are employed wherever a push force is demanded from anchorage tubes. With the addition of properly fitted thick-wall tubes they become plain jacks.

Fig. 35.



Curved Pull Bars (No. 20) are designed to go with the curved tube attachments (**Bs. 16 and 37**), for closing spaces between the labial teeth. At one end of the curved bar is soft-soldered a lug-tube, which is beveled to fit the beveled tube attachment and thus prevent the rotation of the bar when the nut is turned. The lug-end is finished so as to present no irritating edges. The curve of the tubes being proportional to the labial arch, they lie closely against the teeth to which they are attached. See **Ap. 32**, etc.

Fig. 36.

Curved Push Bars (Nos. 19 and 20) are for opening spaces for the alignment of the labial teeth. They can be used effectively upon the labial and lingual aspects. The beveled lug, soft-soldered at the proper point upon the bar, engages with the beveled tube attachment. See **Ap. 10**, etc.

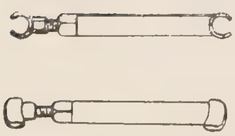
Screw Jacks

Jack Screws, for applying force on the lingual aspect of the dental arches, are among the most useful of regulating appliances. The possibility of interchanging the different forms of jack bars and tubes according to the demands of the case greatly increases the variety of the most needful forms.

Fig. 37.

Plain Jacks are made by fitting a threaded bar with nut into a tube having a thick wall. The tube end rests upon a spur attachment, and the bar end, shaped to a spade form, rests in an elliptic attachment.

Fig. 38.



Bar Rest Jacks are designed to rest upon lingual bars and tubes for the lateral expansion of the arch. There are two forms of end-rests. First (Fig. 38), open tube rests are soldered to short sections of thin tubing. One of these is telescoped into one end of the jack tube, and the other over one end of the jack bar, both of which are finally secured with soft solder. This gives perfect strength and without softening the tube and bar, as would occur if they were directly hard-soldered to the rests. In the second form (Fig. 39) the rests are turned, bored, and finished from **solid** pieces to telescope, etc., as above. The first form is indicated where it is desired to rest the jack upon tubes or large bars as in **Ap. 23**; and the second form, to rest upon lingual expanding bows and bars, as in **Aps. 49 and 51**.

Fig. 39.

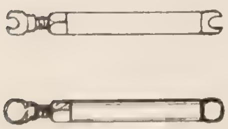
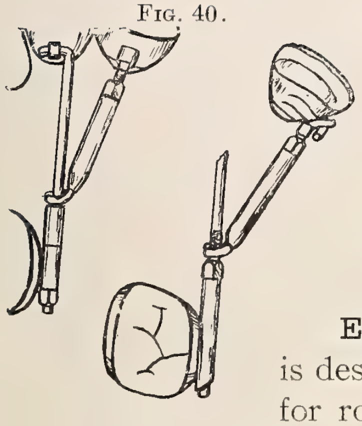


Fig. 40.

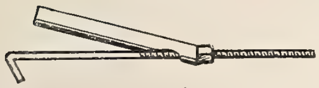


Fork End Jacks (Fig. 40) are designed for engaging the jacks to bars, bows, or pin attachments at quite a decided angle. See **Aps. 18, 20,** etc. Bend a No. 18 wire to the form of a staple and solder it to a short section of round tubing, which is then fitted and soldered to the bar and tube, as in bar rest jacks.

Fig. 41.

Elliptical Rest Jacks (Fig. 41) are frequently useful when it is desired to rest the jack bar upon an elliptical spur attachment for rotating a tooth, as in **Ap. 7.** It is made by soldering an elliptic tube to a short section of round tube, which is fitted and soft-soldered to the bar.

Fig. 42.



Reciprocating Jacks are among the most effective and practical appliances for exerting a pull and push force for the rotation of teeth and for the reciprocal movement of adjoining teeth. A No. 18-28 seamless tube of desired length is cut slightly diagonal at one end. At a point near the diagonal end, on the long side of the tube, a half-round transverse groove is filed, barely cutting through the wall. Then with a small mouse-tail file passed through this opening and out at the diagonal end, a groove is cut nearly parallel to the body, through which should easily pass the jack bar with nut resting upon the diagonal end. The bar may have a hook at one end (Fig. 42) to engage with a short tube attachment, or it may be rolled to a ribbon (Fig. 43) to pass partly around the tooth and button to a pin attachment. See **Aps. 24 and 28.**

Fig. 43.

Fig. 44.

Drop and Arc Jacks are designed to avoid, as far as possible, an interference with the tongue, in a lateral expansion of the upper arch, where it is necessary to rest the jack back of the first bicuspid. The drop jack (Fig. 44) is the more powerful for lateral expansion purposes. See **Ap. 17,** etc. The possibility of also placing the Arc Jack (Fig. 45) so that it will curve forward toward the labial teeth makes it particularly valuable in laterally expanding the anterior dental arch, especially the lower arch, in place of using the straight jacks. See Figs. 6, 7, and 8, Chap. XX. Its invention did not occur until after the several drawings of apparatus were made, which accounts for its not taking a more deserving place among the practical illustrations of appliances, as it has now become indispensable in the author's practice.

Fig. 45.

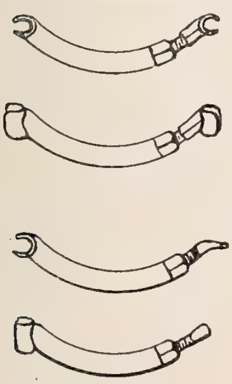
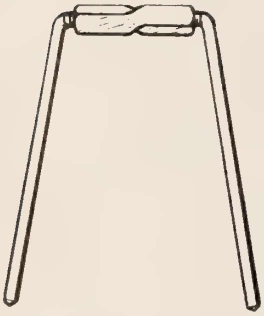
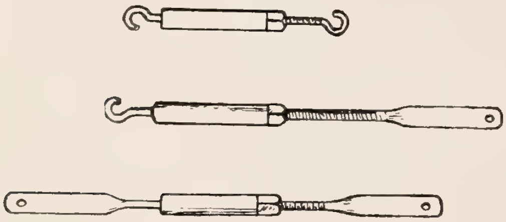


Fig. 46.



Turnbuckle Jacks (Fig. 46) exert either a push or pull force in their various forms. They are almost indispensable in the regulation of teeth, particularly in laterally expanding or contracting the **lower dental arch** where non-interference with the tongue is very important. They are also far superior to **spring bows** in that they can be made to distribute the expanding or contracting force over the entire buccal area, including the cuspids. See **Aps. 54 and 57.**

Fig. 47.



Swivel Jacks (Fig. 47) for exerting a direct pull force are similar to some of the forms of Turnbuckle Jacks. See **Ap. 31.**

The construction of the three last named jacks is so complicated, requiring such a high order of mechanical facilities and skill, a description of this feature would hardly be useful to dentists.

CHAPTER III

IMPRESSIONS AND CASTS

In commencing the correction of an irregularity, good impressions should be taken of the dental arches separately and a labial impression of the front teeth with the jaws in masticating closure. Perfect plaster casts of these impressions will show the exact malposition of the teeth, while the labial cast will enable an adjustment of the upper and lower casts to their occlusal relations.

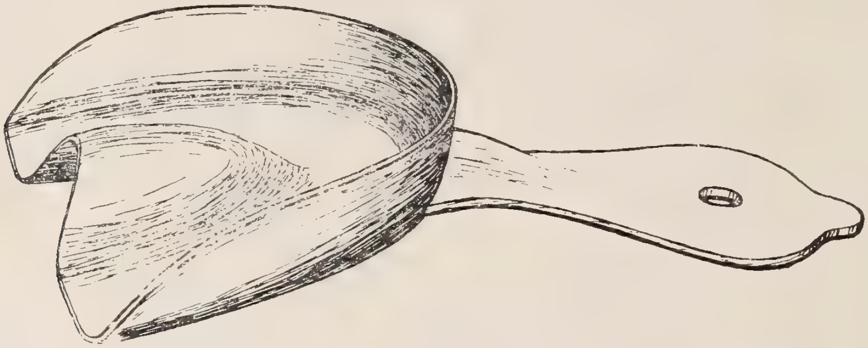
Absolute duplication of the parts, as required for artificial dentures and which may be obtained from plaster impressions, is rarely if ever demanded. In fact, the slight difference, if any, between dental casts made from skillfully taken Modeling Compound Impressions and those taken with plaster, is quite immaterial for all purposes of study and use; nor is it always advisable to attempt so trying an ordeal as a plaster impression at the first sitting with many nervous children and youths. If the occlusal relations of the teeth were a competent guide for their correction, as many seem to think; or if the plaster teeth, instead of the natural teeth, were used for taking the measurements and fitting the bands, it might then be different. Moreover, it is usually advisable to have a number of casts of each case, some of which may be used in holding the measurements and bands in place and in setting up the apparatus, where it can remain undisplaced until the final fitting and attachment at the chair. Again, it is frequently desirable to take impressions for casts during the progress of the case with appliances on the teeth or at times when the apparatus is removed for radical changes of force, and during times when the sensitiveness of the teeth should preclude the exhibition of plaster.

In the author's teaching, competent and successful diagnosis to determine the movements demanded can only be accomplished at the chair, where the natural occlusion of teeth, and the influences which the teeth and alveolar processes exert in characterizing the facial outlines, may be carefully and intelligently studied in all their phases of mal-relation. The author wishes it to be understood, however, that he has no objection to the practice of taking preliminary plaster impressions for models of study — especially by those who cannot or do not obtain perfect impressions with plastic material — if for no other reason than it tends to cultivate habits of nicety and exactitude in other more important branches which pertain to the art of regulating teeth.

For the taking of Modeling Compound Impressions of the teeth, a **Tray** should be selected that can be easily introduced, and one which will carry the compound well over the labial and buccal surfaces of the teeth and gums. Trays shaped

and constructed similar to certain forms of the Ash and Sons' trays, but differing in important particulars to facilitate introduction are procurable, and in sizes adapted to the mouths of children as well as to adults. In Fig. 48 it will be noticed that the buccal extensions are considerably lowered.

Fig. 48.

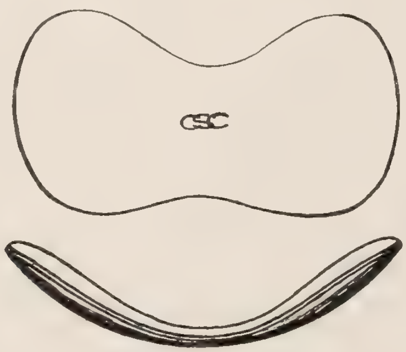


Use good modeling composition, softened in hot water, to a consistency that will take a sharp imprint. Warm the tray and place only a sufficient amount of the compound in it to take the complete impression. See that the impression surface is smooth and free from creases. Finally warm it by dipping the tray in hot water or by passing it lightly over a Bunsen Burner.

In introducing the tray, place it so as to leave plenty of material for the labial portion, and then speedily carry it bodily in a line with the long axes of the teeth to the desired position. While carrying it to place, force the compound against the gums and gingival borders of the teeth and then hold the tray perfectly still until the material is sufficiently hard to remove without displacement.

Upon removal, do not attempt to pull the impression away at the extreme end of the handle, but grasp the tray firmly so as to have complete control of its movement, exerting a slight but firm tilting motion until you feel the first indica-

Fig. 49.



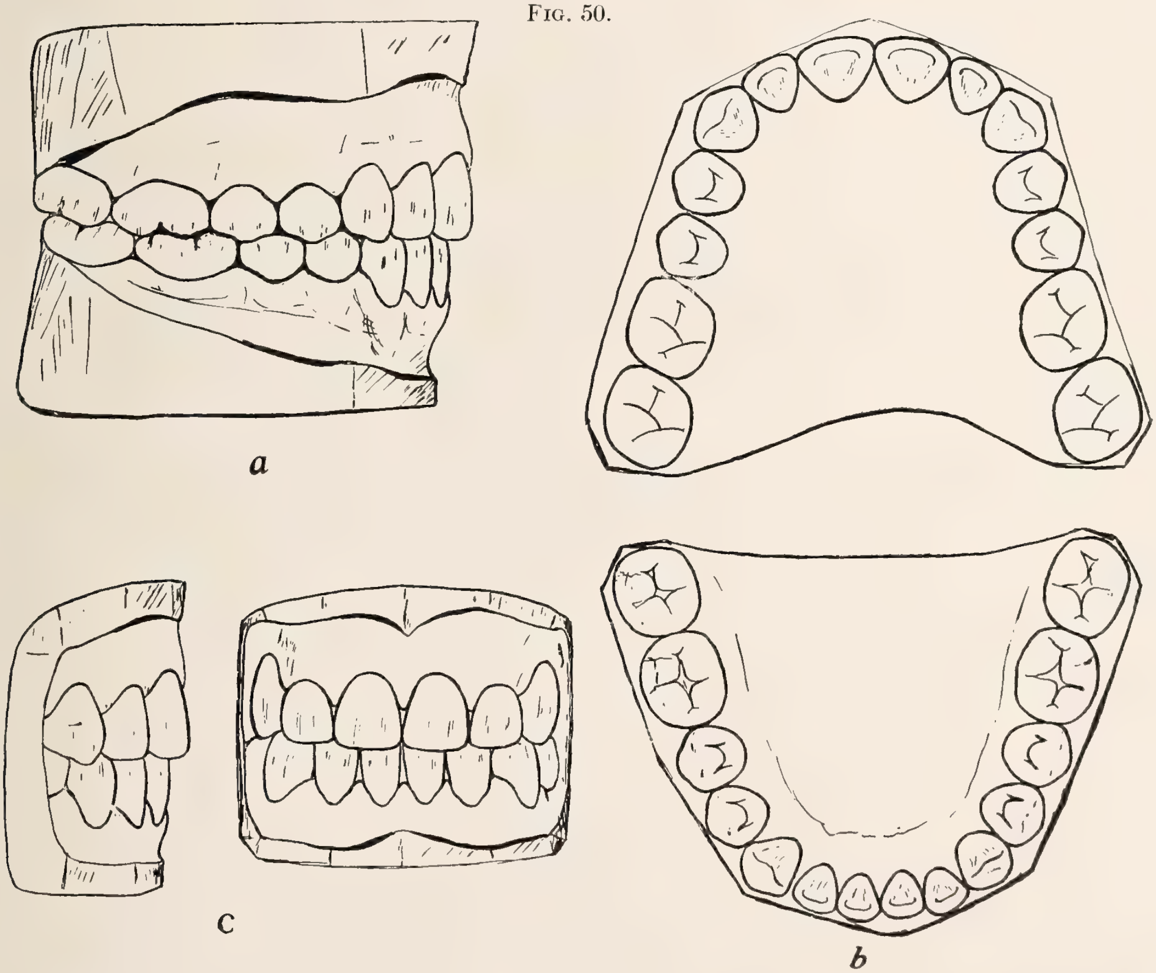
tion that the impression has started to leave its imbedment; then with gentle force partially allow it to take its own direction of movement from the teeth. If it is found that the compound is sticky, work into it pulverized soap stone.

After obtaining good impressions of the upper and lower dentures, take an **occlusal impression** of the labial teeth as follows: — See that the teeth are closed in masticating occlusion and admonish the patient to not open them during the operation. With a small amount of modeling compound placed in an **occlusal tray** (Fig. 49) press it against the front teeth including the cuspids and gums. In removal, ask the patient to open the mouth and gently force it from its attachment to the upper teeth.

Duplicate impressions should be taken at another sitting to insure against imperfections in filling or breakage. The poorer of these are used for working models during the entire process of constructing the apparatus, and to prevent the interchanging of bands.

The filling of impressions is so perfectly described in text-books of other departments that it is not necessary to speak of it here. In the teaching of this branch neatness and precision in shaping the casts should be insisted upon.

Fig. 50.



If the base lines of the upper and lower casts are trimmed as "a" and "b" in Fig. 50, and parallel to the occlusal plane, and the sides and front at right angles to the base from the extreme borders of the impression, it will have a

symmetrical appearance. The occlusal casts, "c" may be trimmed as shown. Do not varnish the casts with shellac. If a preservative is desired, dip them in hot stearine. The name and age of the patient and date of taking the impression should be written plainly on each of the casts.

Facial Impressions and Casts

In all cases of dento-facial deformities, or imperfections of the facial outlines, which are caused by malpositions of the teeth and jaws, **facial plaster casts,** from plaster impressions which exactly represent the natural contours, are far superior to facial photographs for all purposes of study and comparison of the features at different stages of the operation, because they permit an examination of every outline from different angles of observation.

If a **plaster cast** of the physiognomy is indicated the operation should be deferred until you have gained the full confidence and friendliness of the patient. Without this, all operations which require for their success the full co-operation of the patient should not be undertaken.

Say nothing to young patients upon the subject of an impression of the face until you are all ready to take it. Then treat it as a matter of course and with no apparent thought that there will be an objection. Explain what you are going to do and just how they are going to help you; tell them it will not give the slightest pain, and will only take about ten minutes. Exclude parents and friends from the room, or at least from standing by the chair, and have no one looking on within their sight after you commence with the plaster. If the patient is young, do not let him see that this is an intentional ostracism. You know the effect which the consciousness of some one gazing into your face would have upon your control of the facial muscles during a long sitting for a photograph, and how this would be increased if you were allowed to "catch the eye" from time to time of an acquaintance or relative.

Repose him well inclined in an easy position with the face turned from you, and make all preliminary arrangements with the least possible appearance of preparing for a difficult, or even a particular operation.

Have ready a small quantity of white perfumed vaseline in a small thin glass, placed in a clean white bowl of warm water, to partially liquidize the vaseline. Use a large brush — preferably a small shaving brush — so as to apply the vaseline rapidly and to be sure that every part is gone over where you intend to lay the plaster. If the eyebrows are heavy, use the vaseline more or less congealed; nor should any of the vaseline be hot or in a fully liquid state. Do not feel obliged to brush the hair away from the forehead or ears to an unnatural position. It adds to the artistic effect of the model to show a portion of the hair naturally arranged and even partially covering the ear.

Commence with the vaseline upon the cheek, and then the mouth, lips, and teeth — if the latter are exposed. Assure your patient that the vaseline, and also

the plaster which is to follow it, is perfectly clean, that none of it will drop into the mouth even though the lips are slightly open; and to therefore avoid if possible any movement of the lips while the plaster is being laid over the mouth, as it will spoil the natural pose which you are striving to catch. The involuntary tendency of the muscles to tightly close the lips to keep out offensive substances will mar the habitual pose of the lips and chin. This may be easily overcome, even with very nervous patients, with a little patience and kindly persistence in applying the vaseline, which they soon realize is in no wise disagreeable, and that the same will be true of the plaster.

In carrying the vaseline well up under the eye, ask the patient to look upward and tell him that when the plaster is being put on at that point to maintain that position for a few moments, without winking, to prevent the lashes of the upper lid from becoming smeared with it while soft — that it will soon be hard and free from this danger.

Place a small plugget of cotton in the ear, and work the vaseline well into the surrounding depressions and out over the rim. You will now arrange the hair, if you have not previously done so, and vaseline it and the eyebrows as described. Ask the patient to close the eyes, and lubricate the surface of the upper lid down to the lashes; then the depression surrounding the canthus — down over the nose to the very borders of the nostrils; and join that portion of the vaseline which you first laid on. Let the operation be thorough, even to going back over surfaces that do not seem to be well lubricated, as upon this depends the ease of removing the impression. In fact, the titillating effect of the brush is good discipline to the muscles for acquiring immovability during the application of the plaster.

If it is to be a cast of the profile only, the vaseline should stop just beyond the border of the median line of the face. If a front view impression is intended to be taken in one piece, its distal borders should not extend beyond the malar prominences, as otherwise it will be difficult to remove without breaking. However, an impression can be taken in any number of sections by covering the borders of the plaster where you decide to stop with vaseline before proceeding with the next section. These sections can then be removed separately and fitted together before filling. In this way, the whole face, head, and neck can be taken; although I would not advise such an extensive attempt until you have had considerable experience in the work.

Above all things, do not admonish the patient about laughing or smiling, before or during the process of putting on the vaseline or plaster. If you see such a tendency, pay no attention to it, not even when in laying the plaster over the mouth you fear it may spoil the impression. If he is at once made to believe that you are seriously unconscious of his emotions, by some commonplace remark which you may make to your assistant about the weather, or of something you pretend to see out of the window, the danger will usually be averted by leading his

mind into another channel, with an immediate subsidence of the smile before the plaster has become sufficiently hard to be affected by it.

On one or two occasions I have seen, by the slight quiver of the lips and moisture of the eyes of little ones, that the opposite tendency was uppermost. This should be treated in the same way, perhaps with some cheerful, confident remark to your assistant that it will be all over in a few minutes; but by all means with no word or action of sympathy unless you wish them to break down. In almost every case, out of the hundreds of facial impressions I have taken, even for little ones who at first trembled at the sight of the dental chair, they will become seriously and cheerfully interested, because of the fact that they have been made to feel they are in safe hands and that everything will transpire exactly as told them.

In a serious operation of any kind, children should never be treated as babies requiring expressions of sympathy. Treat them rather as individuals of character who possess self-control, pluck, and bravery. They possess the canine instinct of knowing who are their friends, though they will rarely give you their whole confidence in the presence of a loving and sympathetic mother who, unfortunately, will sometimes imagine it helps her children to stand by the chair and hold their hands, etc.

The plaster should be of a fine but slow setting quality. Mix with a slight excess of water that will not chill, and stir thoroughly to a smooth, clinging consistency, which may be handled easily with a spatula and will stay in place on inclined surfaces.

Use for the main work a spatula that is full width but about two-thirds the usual length. This can be made from an ordinary plaster spatula. A narrow spatula should be at hand when needed for certain deep places, or where small quantities of plaster with delicacy of manipulation is required.

Everything being ready, call for the first bowl of plaster. Hold it in the left hand just beneath the face with the arm over the head, and with the spatula lay the plaster first upon the cheek and approach the area of the mouth, extending it beyond the median line, and from the wings and septum of the nose to a point well beneath the chin. Then cover the cheek to the border of the lower lid while the patient is looking steadily toward the ceiling.

The thickness of the plaster should at first be only sufficient for the impression. You will reinforce it finally at the weaker points for strength, when it is not so important to avoid the dragging force of its heft.

In carrying the plaster along from the borders of each spatulaful, give a slight shaking or trembling motion to the spatula, to tease the plaster smoothly over the surface and down into deep depressions, as between lips, around exposed teeth, etc.

The plaster should be handled with skill and delicacy of manipulation, with no abrupt or awkward motion, as, for instance, striking the skin with the spatula — that would cause pain or even surprise and a lack of perfect relinquishment.

The same is true in an ethical sense in regard to all your conversation, words

of warning, direction, etc. Inspire your patient with a kind, cheerful, and confident atmosphere. Never speak loudly or peremptorily to your assistants, as calling to "hurry up with that plaster," etc., or in unkind criticism, even though you have the best of reasons, and things seem to be going all wrong; for the little ones, like the "gallery gods," are quick to note a discordant strain, and it may come at a time when they are all but ready to break down in one way or the other, and at the crucial moment when the plaster has commenced to set over the mouth. Here the slightest movement of the muscles indicative of the emotions will destroy the really important part of the impression.

The advice which was given in explaining the lubricating process, relative to the ethical management of the patient, will be especially important while you are striving to safely pass the critical point around the mouth; after which there is usually little occasion for anxiety.

Follow the same course with the plaster that was described in laying on the vaseline. The first mix of plaster will usually cover the mouth, cheek, ear, hair, and eyebrows, providing that you work rapidly; then you can finish with the second mix; although three and even four mixes are sometimes necessary when the plaster sets rapidly. I like to use the last and thicker portion of the first mix over the hair and eyebrows, as it is not so liable to cling upon removal. To do this, I often skip the ear, to be covered with the first of the second mix. As soon as you feel the plaster commence to thicken, call for another bowl, continuing with the one in hand until it has become too thickened to spread well. If an extra mix is required for finishing the impression of the nose — which should be with plaster that flows readily with a slight shaking motion — have a small quantity of potassium sulphate mixed with the water, then the remaining portion of the plaster will serve to reinforce the impression, and you will not be obliged to wait so long for it to set.

It requires considerable delicacy of manipulation to work the plaster over the upper eyelid till it nearly touches the lashes, and around the borders of the canthus; also at the end of the nose down over the septum and to the very borders of the nostril, without closing the opening so as to obstruct breathing. Do not attempt to put anything into the nose, such as quills, etc., for this purpose; it only serves to annoy the patient and is never necessary.

After waiting until the plaster is hard, place the fingers under the edge of the mesial border of the impression and lift with a gentle force, working it slightly with a lateral movement. Do not use force as you would in removing a plaster impression from the mouth. It will soon yield if the lubrication has been thoroughly performed. If it clings to the eyebrows or hair, as soon as you have raised it sufficiently to pass the fingers or a rubber spatula beneath, you will be able to feel the clinging hair or hairs, and by pressing downward toward the skin, they can be gently dislodged from the plaster. This part of the operation is usually performed by the assistant.

Unhinge it slowly and carefully from the ear, working out the clinging portions of the rim or hair with the finger. The plugget of cotton generally comes away with the impression, where it is allowed to remain during the filling process, and if waxed and shaped to the proper form it serves to represent the external meatus.

In preparing the impression for filling, the eye and nostril holes are covered with wax (externally) in such a manner as to leave the borders well defined, which will allow for an excess of plaster at these points that can be finished by carving. Varnish with a thin coat of shellac, followed with sanderac, and then thoroughly soak the impression in water just before filling. In the process of filling imbed two corks in the back of the cast so as to raise it to the proper angle, if desired to fasten it to a board with screws.

Before separating, soak it thoroughly in warm water and dip it occasionally while chipping off the impression. In other particulars follow the same rules as in separating plaster impressions of partial dentures. In carving the borders of the closed eyelids and open nostril, continue the curves of the natural surfaces; which will cause the greater prominence of the upper eyelid resting upon the lower, and the abrupt deepening at the borders of the nostril.

When the cast becomes soiled at any time later, a thin coat of light pink kalsomine will give it an agreeable flesh color. This can be renewed at any time by washing off the previous coat.

CHAPTER IV

PRACTICAL CONSTRUCTION OF REGULATING BANDS

Separating the Teeth

In practice, when the character of any irregularity and the appropriate apparatus for its correction is determined, the **measurements** of the natural teeth for the required band should be taken. As a preliminary step see that the teeth are sufficiently **separated.** For the purpose alone of taking the measurements the operation of separating should never be performed unless absolutely necessary, as the separators usually require to be left between the teeth twenty-four hours, which with some nervous and sensitive patients is exceedingly annoying, if not painful.

Separating Tape.— In operations for youth, if it is necessary to first separate the teeth slightly in order to force the bands between them for the measurements, use the thinnest and narrowest **waxed tape** that will stay in place without dislodgment. (See Separating Tape p. 23.) Thus, by a gradual approach, the severer conditions that may be found necessary with a greater separation will be withstood later in the operation without a murmur.

Sizes of Tape.— Where space is demanded for taking the measurements, etc., use first the No. 1, and if necessary follow it with No. 2 or No. 3, folded with one edge slightly projecting to facilitate introductions. Where the No. 1 has remained between the teeth for several hours, the folded tapes can be easily introduced and the teeth will speedily respond.

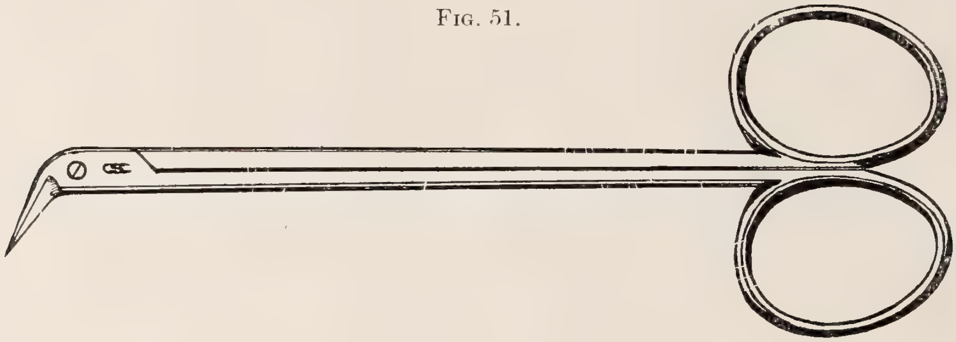
Between back teeth, where the thicker interproximate portions of double band anchorage or adjoining bands of completed appliances are to be attached, the folded tapes will always be necessary. With older patients it may at times be found advisable, especially when the contact point is near or at the occlusal surfaces, to first tie floss silk or twist around the contact point, with the knot in the interproximate space. A few fibres of cotton placed in the loop may in this way be drawn in and held firmly between the teeth.

Method of Introducing Tape.— In inserting the tape, hold the roll in one hand with a sufficient length unrolled to be grasped firmly and extended tautly with the other; then, with the forefingers on the occlusal edge of the tape near to the teeth, press the gingival edge into the space with a sawing motion.

When the separating tape is inserted between the teeth, it is important that it be cut off closely within the interproximate spaces in order that no projecting ends or fraying threads are left to act as sources of irritation or inducements to the

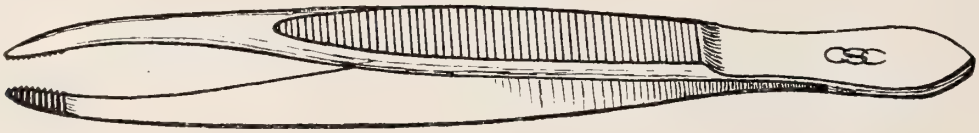
removal of the separators during the twenty-four or forty-eight hours they are required to remain between the teeth. For this purpose scissors should be used with blades that are short, sufficiently narrow, and properly curved to enable the

Fig. 51.



operator to place the pointed ends on either side of the tape as it emerges from its lodgment, and cut it cleanly to the shortest possible length. A fine grade of curved manicure scissors may be used whose blades have been ground to the narrowest limit consistent with strength. **Tape Scissors** that are especially constructed for the purpose, however, as shown in Fig. 51, whose blades are bent in relation to the shanks, will be found far more convenient, especially in reaching the most distal requirements of the back teeth.

Fig. 52.

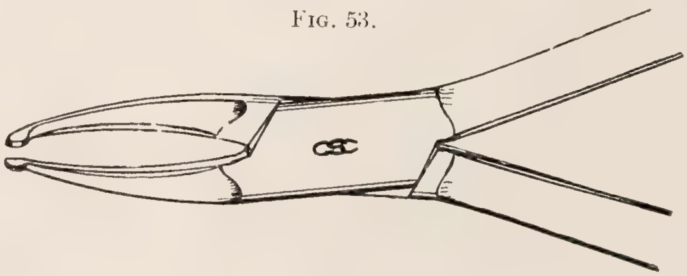


When the separating tapes have been cut off as closely as they should be in this manner, the difficulty of removing them is increased, and it is often impossible with ordinary tweezers and pliers. Fig. 52 shows specially constructed **Tape Pliers** whose beaks are strong and pointed with interdigitating serrations so as to penetrate the interproximate space and firmly grasp the tape.

Band Measurements

For taking the band measurements, the **Banding Pliers**, shown in Fig. 53, is recommended. They are similar to one form of the Howe pliers, though with a

Fig. 53.



much wider space between the beaks, the inner surfaces of which are rounded to prevent pinching the lips and buccal mucous membrane.

The **Band Material** (See Fig. 16, p. 24) should be cut into lengths no longer than required to facilitate adjustment. If students commence with the incisor bands, they will have acquired a certain degree of training for the more difficult molar measurements.

Grasp the ends of the looped piece of banding material between thumb and fingers of one hand and force the loop between the proximal surfaces of the teeth with the other, and while drawing it firmly to place bend it to fit the lingual inequalities, in order to give proper direction to the joint ends. Still holding the ends between finger and thumb, place the open jaws of the pliers with ends resting back upon the band on either side of the joint. Pressing the band against the tooth, bring the jaws firmly together, and move the pliers slightly to and fro to sharply bend the joint marking.

Carefully remove each band as it is measured to avoid obliterating the mark, and place it on its proper tooth of the working model — the teeth of which have been sawed apart for this purpose. Proceed in a similar manner with the cuspids and bicuspids.

Molar Measurements.— The molar bands being much thicker and more rigid are more difficult to adjust and perfectly fit; considerable force, often with the pliers, is required to force the band between the teeth. If the spaces, however, are insufficient, insert the wider folded tape. Fifteen or twenty minutes will usually be sufficient — the teeth having become slightly loosened with the first separation.

When the band material for a molar band is placed, grasp the distal end with the pliers and bring it firmly forward, sharply bending it at about the middle of the buccal surface. Then grasp the mesial end, and carry it back with the sharp bend at a point that will leave the two joint surfaces about ⅛ of an inch apart.

Now include both ends in the grasp of the pliers and, while forcing the beaks against the tooth, bring them firmly together, as described for the incisors. If the bands are wide and thick, it may be well to regrasp — starting back from the joint — and repeat the movement. In fact, after a band is soldered and found to be too large, a tuck can be taken up in it in this way, showing the utility of the movement for drawing the band to a perfect fitting.

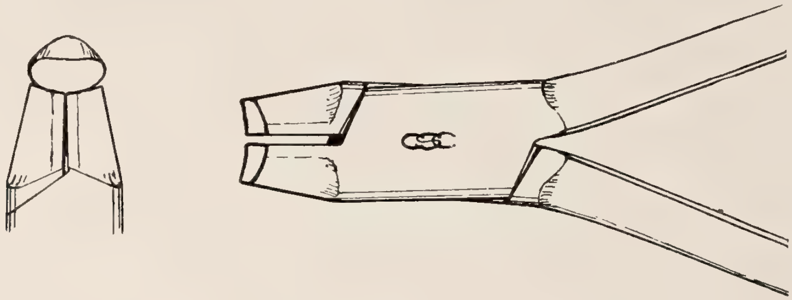
Measurements for Partially Erupted Teeth.— A perfect fitting band can be made for a cuspid not fully erupted without causing more than slight pain, if the measuring process is managed properly. Loosen the surrounding gum covering the enamel, which will be found to have slight attachment; then carefully work the loop of the band, held as described, beneath the lingual border of the gum. Sometimes it can be passed under the linguo-gingival border the full width of the band without even drawing blood. By cutting the ends short they can be lapped under the labial border of the gum as far as necessary, marking the edge instead

of pinching a joint for soldering. This former movement is rarely necessary, however, as the shape of the cuspids does not require the band to pass far beneath the labial gingivæ.

Soldering Bands

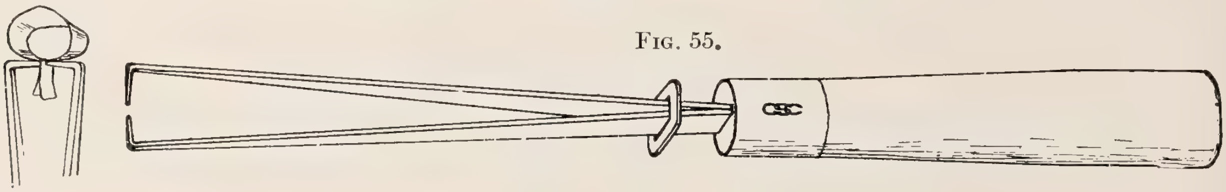
Preparatory to soldering the joints, the ends of the bands should be cut off to about ¼ of an inch, then placed in the grasp of the **Band Burnishing Pliers** (Fig. 54)

Fig. 54.



or a blunt square-nosed pliers, and burnished on the inside of the band so as to carry the crimped markings deeply between the jaws, to form a perfectly united joint when soldered. Commence the soldering process with the molar bands because they are thickest and not so easily burnt by a beginner.

Fig. 55.



In placing the band in the grasp of the **Solder Pliers** (Fig. 55), see that the joint edges come evenly and perfectly together and then place a very small quantity of borax — either in the powdered or liquid form — immediately over the joint.

Direct the blaze of the blow-pipe *on the ends beneath the joint* — not above it — and first fuse the borax so that it is drawn into the joint with little or no flow upon the inner surfaces of the band. The ends of the **solder pliers,** being bent at right angles, permit perfect freedom in this regard. Now place a piece of No. 1 **silver solder** (See p. 24), about $\frac{1}{32}$ of an inch square, immediately over the joint and direct the blaze as before, drawing the solder down into and filling the closely united surfaces of the joint. Careful management of the borax and blow-pipe will prevent the solder from flowing out upon the inside of the band.

Preliminary Fitting of Bands

After the joints have been soldered it is usually an advantage to fit the bands to the natural teeth, to correct any imperfection in size and to mark the position and direction of attachments. In giving to the band the exact shape of its tooth

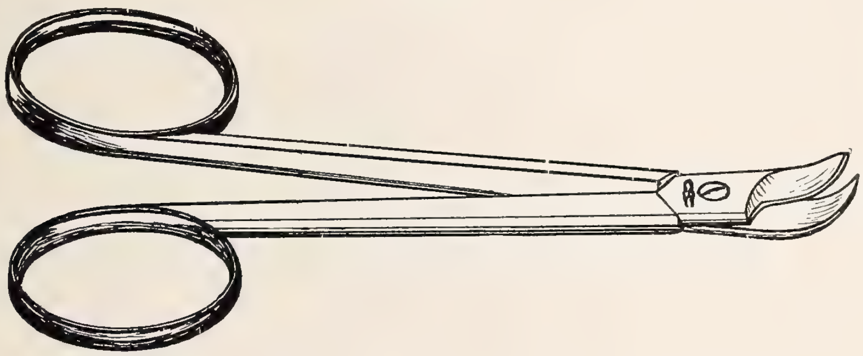
zone, insures greater perfection to the fit of attachments, especially those of the long tubes upon molars.

At this time the borders of the bands may be trimmed so they will not extend beneath the borders of the gum or lie upon occlusal surfaces. Whenever it is necessary that the edges extend under the gingiva, they should always be carefully burnished to fit the surfaces of the teeth at the time of cementing them. Where attachments are to be soldered to front bands merely for the purpose of bow rests, or where there is no great tendency of the force to dislodge the band, the labial surfaces may be considerably narrowed. An apparatus similar to **Aps. 75 or 76**. requiring an alignment bow No. 22, for the retrusion of the labial teeth can in this way be made quite inconspicuous. In all of the **drawings of apparatus** in this work the bands are shown wide, for the purpose of more distinctly illustrating the attachments and their respective positions. They should not, therefore, be viewed as the finished band in this particular.

The lingual and buccal portions of molar and bicuspid bands should be contoured and the sharp edges filed preparatory for the final finishing.

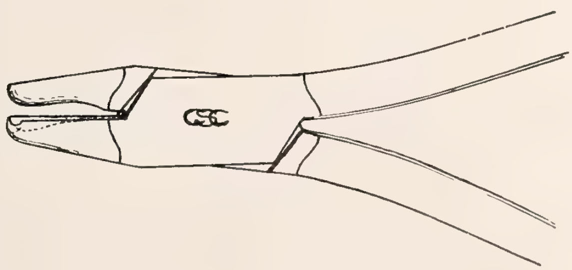
The instruments necessary for the above work are: **Curved Scissors** (Fig. 56);

Fig. 56.



a six-inch half-round **jeweler's file** No. 6; a six-inch **rat-tail file** No. 5; and the **Band Contouring Pliers,** Fig. 57. The latter are far more perfectly adapted for

Fig. 57.



this work than the ordinary crown contourers, as they are constructed to avoid crimping the edges of the band.

The Technics of Band Fitting

One of the essentials to the perfect retention of a band is that it should fit the teeth as tightly as it can be driven on. Some writers have instructed that the bands should fit somewhat loosely, so as to leave space for the cement; which is about as reasonable as leaving a space for the cement or glue in mending broken earthen or glass ware, or in making a wood joint.

In taking the **measurements** it requires considerable practice to draw a band — especially the thicker ones — around a tooth tightly and sharply bend it for the joint; nor can it be done as easily with any of the ordinary pliers as with those of more delicate ends having somewhat sharp edges, which will bite into the band material itself while pressing the band against the tooth in bringing the joint surfaces closely together. I frequently make this movement at different points, with wide and thick bands.

Again, in burnishing the joint preparatory to soldering: if the joint has not been sharply marked, it requires considerable judgment to avoid leaving the band too large, by failing to force the joint sufficiently into the grasp of the burnishing pliers. In fitting a band on a tooth after it is soldered, if it is found to be slightly too small it can be easily enlarged on the horn of an anvil.

Relation of Coronal Zones

It is not stated in Black's admirable and exhaustive Anatomy of the Teeth, or elsewhere to my knowledge, that the circumference measurements of the different **coronal zones** of teeth bear quite a definite anatomical relation to each other. This I believe to be an important factor in the consideration of fitting bands to the crowns. It teaches that bands which are properly proportioned in this regard can be forced on the crowns of any of the teeth and fit their surfaces with considerable accuracy, from an occlusal zone which is marked by the distal and mesial angles, to a gingival zone near the proximo-gingival borders of enamel. The relative circumference of these zones which are marked by the edges of the band, and a zone that lies midway between, will be found quite definite in all teeth of the same character.

The relative circumferences of the crowns of **incisors** and **cuspids** — upper and lower — gradually taper in size from the gingival to the occlusal zones. The incisors taper in the proportion of 2 to 1 in 4 inches, and the cuspids 2 to 1 in 1 inch. That is to say, bands of the proper size that are made to fit mandrels which taper in this proportion will quite accurately fit these teeth from the mesio-distal angles to the linguo-gingival ridges. These bands should be festooned, so as not to extend far beneath the interproximate gingivæ, and to secure a perfect fit of the cuspids the labial surfaces should be contoured.

With upper bicuspids and the upper and lower first and second molars, the gingival band zones are about the same size as the occlusal, but the largest zone

lies between, somewhat nearer to the gingival. If bands are made of the proper size upon a mandrel which tapers in the proportion of 2 to 1 in 12 inches, and of a width that covers well the buccal and lingual surfaces, and is festooned so as not to cover the occluso-mesial and occluso-distal ridges on the one hand, nor extend far beneath the interproximate gingivæ on the other, and then are contoured on the buccal and lingual sides so as to draw in the occlusal edges, the bands will be found, when driven on, to fit these teeth from the gingival to the occlusal margins quite accurately.

With lower bicuspids the occlusal and gingival zones are about the same size, the two zones lying nearer together and with no marked difference between them in proportional taper. If bands are made for these teeth of the proper size, with very slight taper, and as above, in other particulars, they will be found to fit with sufficient accuracy for all practical purposes.

From this it will be seen that if **bands** are shaped and contoured properly and are of the right size and taper they may be **driven** on the crowns to a point where they will tightly fit all the surfaces. Again, there is usually so much difference between the general sizes of the right and left tooth, even though not perceptible to the eye, that if the bands are transposed they will commonly be surprisingly too large or too small. Therefore, in taking the measurements, a model should always be at hand upon which the bands can be placed in their respective places when removed from the teeth; a precaution that should be strictly observed throughout the entire construction of the apparatus.

Placing Bands

In placing a band upon a tooth, one should be able, on account of the slight conical shape of the tooth and band, to force it nearly to place with the fingers or thumb, if the spaces between the teeth will permit; after which the use of a hickory or hardwood **Band Plugger** (Fig. 58), to be used with a heavy mallet, is in-

Fig. 58.

valuable. The broad and somewhat yielding surface of the wood resting upon the edge of a band — especially when it is nearly in place — will not double or mar the edge as will any steel instrument. It will also catch the edge that has passed the occlusal angle and enable one to force it to a more perfect fit than seems possible with anything else.

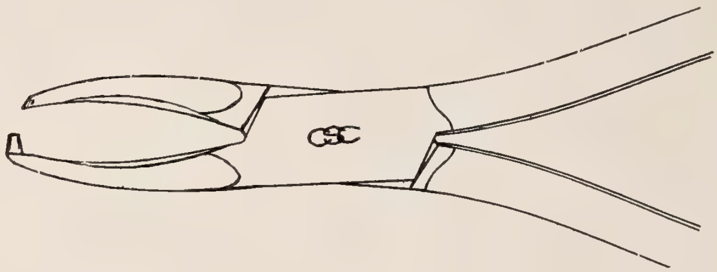
A heavy **Lead Mallet,** one weighing 6 ounces, will be found far more effective and cause less pain to the patient than one of the ordinary lighter kinds used for filling. With the same amount of momentum, the velocity is decreased in pro-

portion to the weight, producing a blow that approaches a push force, without rebound, and being one of a more distributing quality will not produce the amount of shock to sensitive teeth which often obtains in the use of lighter mallets.

Removal of Bands

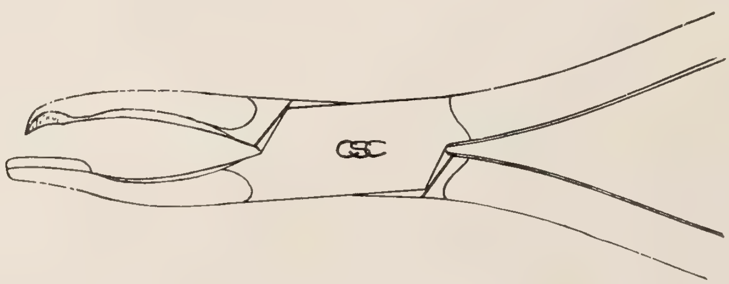
The removal of bands that have been perfectly fitted and driven on the teeth is made easy with the **Band Removing Pliers** (Fig. 59). These are constructed with one jaw to engage with the gingival edge of the band, while the other, which

Fig. 59.



is longer and turned at right angles, is shod with copper to rest upon the occlusal surface and act as a fulcrum, without danger of cracking the enamel. The shape of the extreme end of the fulcrum beak is such that while retaining its position upon the tooth, it enters the band as it is being lifted, thus permitting its free disengagement. These pliers are indispensable for the removal of cemented and uncemented bands, for the purpose of changing their position or to add attachments for the application of other forces. The reciprocal action of the two beaks causes little or no strain upon the teeth and consequently a minimum amount of pain to patients, as would certainly always arise in such an attempt with a free hand action of any instrument lifting or pulling upon the band.

Fig. 60.



Slitting the Bands. – When a preservation of the band is unnecessary and its removal is at all difficult, it should be cut with the **Slitting Pliers** (Fig. 60). The longer fulcrum beak is shod with copper to rest upon the occlusal surface of the tooth without injury to the enamel, while the shape of the cutting beak is peculiarly adapted for slitting the band.

Soldering Attachments

Preparatory to soldering attachments the bands should be first festooned and the bicuspids and molars perfectly contoured, and then replaced upon the plaster model in the exact position they are intended to occupy on the natural teeth in order to determine and mark the correct positions and directions of the attachment; after which remove the band and hold the parts together in the **solder tweezers.** Use plenty of borax and sufficient No. 1 solder to form perfect union and finish. When two attachments are to be soldered to the same band, use No. 2 solder for the first, and No. 3 for the second. The soldering of attachments to bands while they are placed on the ordinary plaster cast is not good practice. Nor is this ever called for to obtain the correct positions of attachments, though great care should be taken to mark upon the band the position and direction of the attachment, and then in removing the bands from the model, the natural tooth shape of the band should be preserved, especially for fitting and soldering long bearing attachments. For long **rotating** and **molar tubes,** groove the band with a **fine round** or **joint file** to give the tube a long bearing close seating, while preserving the natural contour of the band. With **anchorage tubes,** leave no projecting distal end more than is necessary to turn the nut; and where there is no distal nut, bevel and finish the distal end of the tube to prevent the laceration of tissues.

In some instances when the apparatus is complicated, or requires special care as to the position of the attachments in relation to the teeth and gums, a plaster impression of the teeth with the bands in position with a view of placing them on **an investment model** in the exact positions they occupied on the teeth, will be found of advantage.

The only objection to this procedure in all cases, is the necessity of heating up a large model when the soldering of the attachments can usually be accomplished far more easily and quickly while held in the solder pliers, and with sufficient perfection, if their positions have been properly marked upon the bands.

When an investment is necessary the plaster should be cut down to the smallest size consistent with strength. If it involves the entire arch, a horseshoe piece of roughened metal imbedded in the investment will aid in the safety of reducing its size.

Specific directions for constructing and soldering the different attachments will be found in Chapter V.

Finishing and Plating

Upon the completion of soldering the band attachments, etc., the parts should be boiled in a solution of sulphuric acid, then neutralized in a solution of sal-soda and rinsed to remove the borax and loosen the oxide preparatory to **polishing** and **plating.**

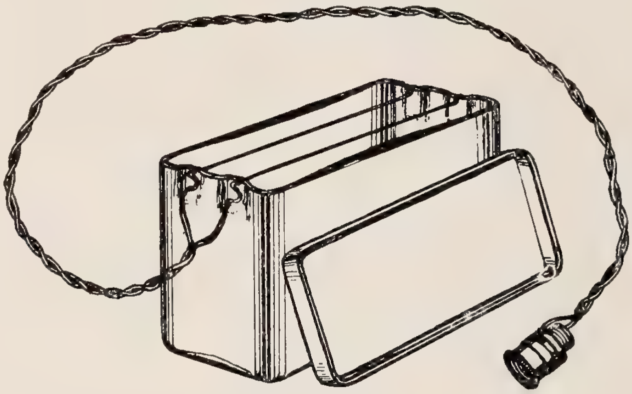
In finishing, hold the bands on a wood mandrel, somewhat the form and taper of the respective teeth. All sharp and projecting portions that are liable to irri-

tate the mucous membrane should be removed, and the surfaces rounded. Polish on a felt wheel followed with a coarse hair brush wheel, using tripoli throughout. Occasionally a fine brass wire scratch brush is used for the final polishing and burnishing.

If care has been observed to prevent oil or grease of any kind from coming in contact with the parts, they can be carried immediately into the plating solution; otherwise, they should be cleansed in a hot strong solution of caustic potash and rinsed thoroughly in hot water.*

The best **Plating Outfit** for regulating appliances is the one shown in Fig. 61. It takes its current directly from the Edison 110-volt direct current, through the medium of a series current tap supporting a 16-candle-power lamp. If this seems to produce a current of too high voltage, it may be reduced one-half by inserting an 8-candle-power lamp. Where the direct current is not at hand, a single 1 gal. cell (Daniel, Smee, or Bunsen, or preferably, an Edison Lelande) can be substituted.

Fig. 61.



The gold plating solution advised by the author is made by dissolving 30 grs. of Mallenkrodt's Gold Chloride in about 1 qt. of hot distilled water, and adding cyanide of potassium C. P. until the solution is cleared. Use cold or slightly warmed. This solution contains far less cyanide than the usual solution recommended, and will be found to preserve the anode much longer. Use for an anode a piece of pure gold plate about 2 inches square. This should be removed from the solution when not in use. After plating the parts, polish with whiting on a soft hair brush wheel.

*A very instructive Chapter on Plating will be found in Guilford's "Orthodontia," Third Edition.

CHAPTER V

CONSTRUCTION OF REGULATING BANDS IN DETAIL

This chapter contains a description of the construction in detail of each band which appears in the drawings of the regulating apparatus in this work. It is especially designed to avoid the necessity of repetition in the general text.

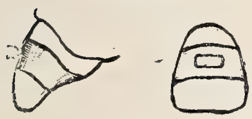
The teacher is expected to select the most practical kinds desired for the students' technic work.

The sizes of the attachments will not be repeated in the text where they are properly marked on the drawings of the individual bands.

Nearly all the bands which appear on the upper teeth in the drawings of apparatus are equally applicable for the lower.

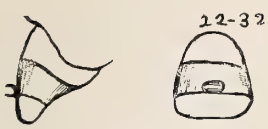
INCISOR BANDS

INCISORS

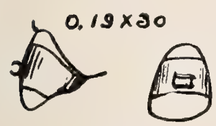


No. 1

No. 2



No. 3



No. 4

No. 5

Bands 1, 2, and 3, illustrate open tube band attachments for alignment and retruding arch bows Nos. 20, 22, and 23. The bands differ from each other only in the position of the attachments which are cut from specially drawn open tubing. The attachments may also be made from thin round tubing. In preparing to solder the attachment, slightly groove the band with a fine mouse-tail or joint file, marking the position and direction for seating the tube. Hold it in place with the solder pliers, the joint of the tube being turned away from the band. Use only sufficient No. 2 solder to unite the contact surfaces. In other particulars follow the general directions under Soldering Attachments in Chapter IV.

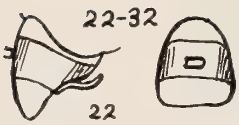
Band 4.—Same as above for arch bows Nos. 18 and 19.

Band 5.—Same as Band 4, with the addition of a short lingual open tube attachment for the purpose of engaging with a lingual bow. See **Ap. 49.**

Incisors

No. 5½

Band 5½.—Hook attachment No. 18 for a lingual protruding bow. The hooks can be made from specially drawn hook wire (See p. 17) or from round wire annealed and rolled to about one-half its diameter. To form the hook, give the wire a double curve with the **step pliers** so that the hook when soldered will stand free from the band. Round the end with a fine file and cut off the hook. The surface to be soldered may be filed to make the attachment hug the band closely.

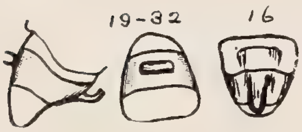


No. 6

Band 6.—Alignment band with lingual hook 22, to which may be attached a silk or wire ligature to force the tooth forward or rotate it. See **Ap. 51.**

No. 6½

Band 6½.—Designed for the lower sustained anchorage apparatus. The lingual hook is soldered to project beyond the gingival edge of the band, to support a heavy lingual bow to prevent the anchorage teeth from tipping forward. See Fig. 31, Chap. VII.



No. 7

Band 7.—A larger hook and open tube for a No. 18 lingual protruding bow, and a No. 19 arch bow. See **Ap. 69.**

No. 7½

Band 7½.—The pin-head attachment, suggested by Dr. E. H. Angle, is exceedingly useful in place of hooks for attaching wire ligatures. It is turned from German silver wire and soldered to the lingual surface of any band. See **Ap. 34.** This band also carries a labial open tube attachment.

No. 8

No. 9

Bands 8 and 9.—Small labial hook attachments which are often preferred to the open tube attachments. They are especially applicable for intruding and extruding the incisors. See **Ap. 5.**

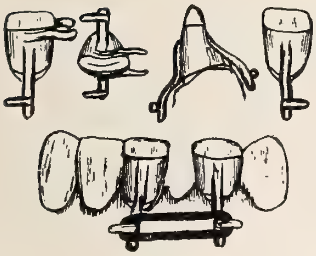
INCISORS

No. 10

Band 10.— Ribbon attachment, suggested by Dr. A. E. Mattison, for forcing contruded teeth to an alignment bow. The attachments are made of narrow strips of No. 30 German silver or gold plate, and soldered to the band to project at a right angle. When in position, the extreme end of the attachment is curved down or up to form a hook which is lapped around an alignment bow which is sprung back into its grasp. The attachment is gradually shortened from day to day as the tooth is forced to position. It has the advantage of having a longer reach than the ordinary open tube or hook attachment which renders it especially useful for contruded bicuspids. See **Ap. 6**. In most instances it is also far superior to wire ligatures for forcing teeth out to an alignment bow.

No. 11

Band 11.—Labial and lingual hook attachments used to close spaces between teeth with rubber bands. See **Ap. 60**.



No. 12

Band 12.—Shows bands for moving the roots of front teeth laterally to close wide spaces between front teeth. They are especially useful where a lower incisor has been extracted from a crowded arch. The root-wise extension attachments, labial and lingual, with T spurs for the attachment of rubber rings, are made of No. 18 round wire and bent to conform to the curve of the gum. These bands go in pairs, one of which carries guide pieces or forks made of hook wire No. 22 soldered at the occlusal edge, as shown by the drawing, to prevent them from overlapping when they are forced to contact. In this position the contact point becomes a fulcrum to the tooth levers of the third kind. See **Aps. 63, 64, and 65**.

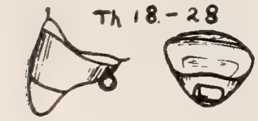
No. 12½

Band 12½.— Carries but one root-wise attachment which may be placed on the labial or lingual aspect; employed where the teeth also demand rotating.

No. 13

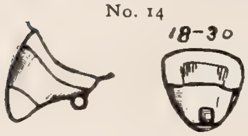
Band 13.— Rotating tube attachment, preferably made of seamless tubing. See Chap. I. Before soldering the tube, the band should be slightly grooved with a round file to closely seat the tube in the desired position and direction. In this process, remember that the band is thin and you are liable to raise a welt on its inner surface. The principal portion of the tube should be soldered on that side of the band-joint which is opposite to the direction of rotation, with one end just spanning the joint.

Incisors



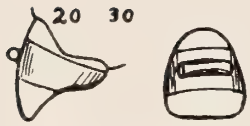
No. 14

Band 14.— Threaded tube attachment for a No. 18 lingual bar. This is cut from round seamless tubing No. 20–28; bored and tapped with a No. 18 drill and tap, the same as a nut. See **Ap. 13.**

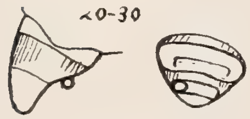


No. 15

Band 15.— Short tube attachment, very useful for attaching a traction bar or jack. See **Ap. 24.**



No. 16

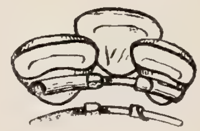


No. 17

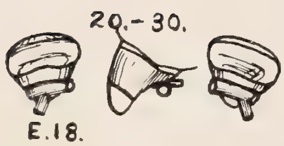
Bands 16 and 17.— Curved tube attachment bands for lateral pull or push screw-bars on the labial and lingual surfaces respectively. See **Aps. 10 and 11.** The tubes should be slightly curved before soldering. The illustrations show methods of attachment.

No. 16

No. 16



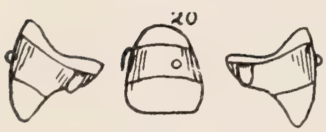
No. 17



No. 18

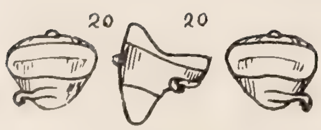
Band 18.— Same as 17, with an elliptical tube attachment for a jack rest. See **Ap. 20.**

No. 18



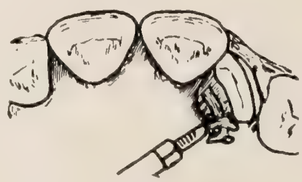
No. 19

Band 19. — Devised to be used with the ribbon rotating traction bar (p. 27). The button attachment is a No. 19 round wire soldered to the band at right angles, and cut off so that it projects about $\frac{1}{32}$ of an inch. The end is then rounded in the form of a button and a thin slot is sawed or filed on one side of the pin to firmly button to a ribbon traction bar or reciprocating jack. The band is also supplied with a shield attachment made of No. 36 band material to prevent the ribbon from sliding too far under the gum. See **Aps. 28 and 30.**



No. 20

Band 20.— Same as 19, with a lingual hook rest attachment instead of the shield to engage with a fork end jack. See **Ap. 29.**



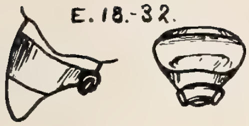
No. 20

INCISORS

No. 21

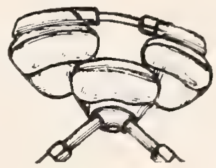
Band 21.— Same as 20, with a rotating tube instead of the button.

No. 21

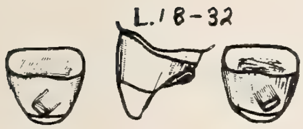


No. 22

Band 22.— Curved elliptical lingual tube attachment to engage with two spade end jacks. See **Ap. 14.** Round seamless tubing 18–20 is bent in the form of a ring the proper size and the ends tacked. It is then flattened in the rollers to the desired ellipse and cut into short sections.



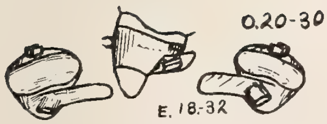
No. 22



No. 23

Band 23.— Elliptical tube attachment to engage with lingual jack. One end of the tube is pinched together where it joins the band and soldered at the proper angle to receive the spade end jack bar. See **Ap. 19.**

No. 23



No. 24

Band 24.— Designed for lateral incisors in an apparatus for opening space for the eruption of cuspids. The elliptical tube jack rest is soldered to a narrow 28 g. extension that engages with a lingual hook on the central. The band also carries an open tube attachment to engage with a lug attached to a protruding bow from a movable anchorage. See **Ap. 67.**

No. 25

Band 25.— In applying retruding force at the highest gingivo-labial border of an incisor, the point of attachment should be raised from the tooth to enable the retruding bow to span the interproximate gingivæ. The attachment is made of No. 14 wire, shaped to fit the face of the tooth and rest firmly at the very gingival border. It is a useful band where it is desired to moderately distribute the force to the roots with a retruding bow No. 18 or No. 16. See **Ap. 77.**

INCISORS

Bands 26 and 27 represent the most modern method of constructing the incisor bands for the Contouring Apparatus* for protruding the incisor teeth bodily. **Band 26** is designed to be used where the required movement is slight, and again in cases of extreme youth when the greater force is not demanded. The upright attachments are made of No. 14 round wire filed to fit the face of the tooth and soldered at one side of the joint to take a position in a line with the central axis. The root-wise extension is filed to engage with a No. 16 power bow, which with this band is placed about even with the highest gingival border of the central. At the occlusal end of the upright is soldered an open tube 22–32 to engage with the No. 22 fulcrum bow at the incisal end. **Band 27** is similar to 26 except that it is constructed to receive a greater magnitude of force. The bands should be wide, No. 38 or 37, and extend to the extreme gingivo-lingual and labial borders. The uprights are filed out of No. 13 round wire to engage with a No. 13 power bow above the gingival border. It will be seen that the root-wise extension contains nearly the whole body of the wire at the point of its greatest strain where it leaves the band, and is architecturally tapered and finished to the force point to avoid objectionable prominence and irritation of the lip.


No. 26

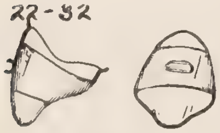

No. 27

Band 28.— Designed to exert a retruding force upon the roots of the front teeth and a protruding force at the occlusal zone — principally for retruding the roots. The attachments are filed out of No. 13 wire and are so well shown in the illustration they will require no description. See **Ap. 83**.


No. 28

CUSPIDS

22-32


No. 30

19-30


No. 30½

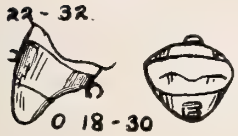
CUSPID BANDS

Band 30.— Open tube attachment for alignment bow rest.

Band 30½.— Same as 30 for a retruding bow rest with the addition of a lingual hook.

*In introducing the method for bodily protruding and retruding the front teeth, the author named it the Contouring Apparatus, because of its power to correct facial outlines.

Cuspids



No. 31

Band 31.— Same as 30 with the addition of a lingual bow rest.


No. 31½

Band 31½.— Lingual pin-head attachment for the Angle wire ligatures. The band also carries a labial open tube attachment to clasp and steady the bow. See **Ap. 34. B. 7½.**

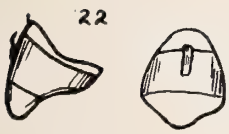

No. 32

Band 32.— Designed to be used with the headgear apparatus and in the application of intermaxillary force for retruding the cuspids alone or with all the front upper teeth. See **Ap. 77.** The labial attachment is made by soldering an open tube to a lift, to raise it from the tooth where it may more readily engage with the sliding hook for the attachment of the intermaxillary elastics. To counteract the rotating influence of the force and aid in the retrusion, the band has also a lingual hook for the attachment of an elastic to extend to the upper anchorage.


No. 32½

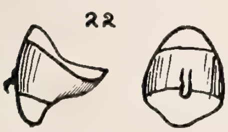

No. 32½.

Band 32½ is designed to support a lingual bow or a turnbuckle jack expander, etc. The attachment is made of tubing 14-28. The end that is to be soldered to the band is beveled and then cut off from the tube and soldered as shown. This permits the angle of the expander to take a more distal location on the cuspid, which is at times demanded but not possible with the ordinary open tube or hook attachment.



No. 33

Band 33.— Shows alignment hook attachments same as Bands 8 and 9.

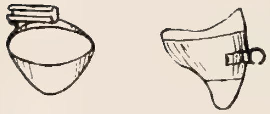


No. 34

Band 34.— Same as Band 33 with hook reversed.

Cuspids

Band 34½— Labial attachment, designed to prevent the rotating tendency of the intermaxillary force. Its construction and application is fully described in the text under **Ap. 77.** It is one of the most practical designs for a retruding movement of the cuspids, especially after the extraction of the bicuspids. It is particularly designed for the application of the intermaxillary and occipital forces, and when employed with a mesial hexagon nut it now frequently takes the place in the author's practice of **Band 40,** to retrude the cuspids from stationary anchorages.

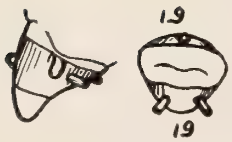


No. 34½

It is made by soldering the mesial end of a thick seam tube to the band slightly in front of the center of its labial face, while the distal end is supported by a lip of the tube turned at right angles and soldered to the distal surface. The seam of the tube is placed to open on the gingival side so as to facilitate placing the arch bow after the band is cemented, and also for the removal and replacing of the band, should it become loosened. Its peculiar attachment to the tooth and long-bearing connection with the bow is favorable to an inclination movement, and the prevention of rotation. See **Ap. 77.**

Band 35.— Designed for rotating the cuspids with the ribbon reciprocating jack. See **Ap. 28.** The labial button and shield are the same as B. 19. In addition, the band supports two pin rests for the jack-tube. The band should be cemented so as to bear the relations shown in **Ap. 28.** If the tooth is to be considerably rotated, it may require the second pin rest. This is a most effective and sure way of rotating cuspids where it can be applied.

No. 35



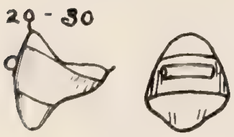
No. 35

Band 36.— Rotating tube attachment the same as B. 13.

No. 36

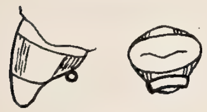
Band 37.— Curved tube attachment the same as B. 16. See **Ap. 22.**

No. 37

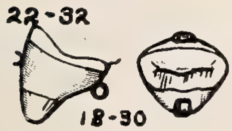


No. 37

Cuspids

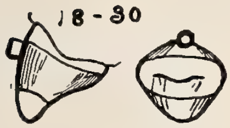

No. 37½

Band 37½.—Curved lingual tube attachment same as B. 17. See **Ap. 12.**



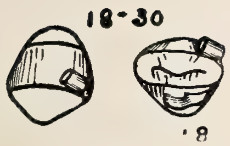
No. 38

Band 38.—A short lingual tube attachment for a traction bar or jack, and an open tube labial rest for an alignment bow. See **Ap. 25.**



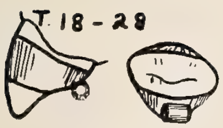
No. 39

Band 39.—Designed for retruding cuspids that require slight rotation with a traction bar from a stationary anchorage. See **Ap. 73.** The attachment is a short tube soldered in an upright position to allow a hinge movement and at a point the most distant from the central axis to obtain the greatest rotating leverage.



No. 40

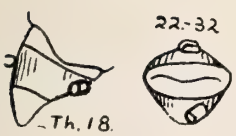
Band 40.—A common attachment for traction bar to retrude the cuspids. It is soldered near the occlusal border to exert force as near as possible in a line with the central axis and is placed so as to have a rigid bearing, both of which are designed to prevent rotation. The band also carries a lingual hook for a rubber band to counteract any tendency to rotate. See **Aps. 75 and 76.**



No. 41

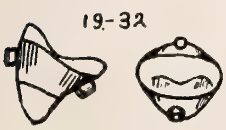
Band 41.—Lingual screw threaded tube attachment 18-28 the same as B. 14. It is especially useful for attaching a bar for an expanding jack-rest — the distal end of the bar to be supported in a lingual molar tube. The bar can also be threaded with a nut at the distal end of the tube to exert a traction force. The band also has a labial open tube for an alignment wire rest. See **Aps. 13 and 16.**


No. 41



No. 42

Band 42.—Same as B. 41, except that the screw tube attachment is soldered on the diagonal to permit the bar to safely pass the bicuspid.

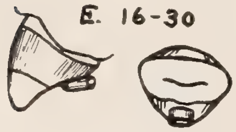


No. 43

Band 43.—Designed to rotate the cuspids, with a traction bar on one side and a push bar on the other, both extending from tubes on a molar anchorage. This principle is shown in rotating a bicuspid in **Ap. 29.** One of the bars may extend around to the other anchorage and act also as an alignment bow. See **Ap. 33.**

Cuspids

E. 16-30



No. 44

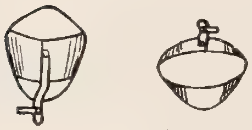
Band 44.— Elliptical tube attachment for a spade end jack-bar rest.

No. 45

Band 45.— A lingual jack-rest designed to exert a slight rotating force in connection with the general movement. The attachment is made of No. 18 round wire. It can also be flattened for an elliptical jack-bar. See **Ap. 7**.

No. 46

Bands 46 and 46½.— The same as Bs. 12 and 12½. See **Ap. 64**.



No. 46½

No. 47

Band 47.— The same as B. 26. The cuspids are not usually included in the regular protruding Contour Apparatus, and in fact only in those cases where the greatest power is to be exerted by the retruding, or so-called "fulcrum" bow at the occlusal zone — the power bow acting principally as a fulcrum. The apparatus is designed to retrude the occlusal zone and protrude the apical. See **Ap. 82**.

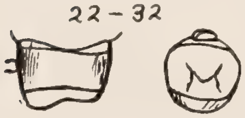
No. 48

Band 48.— The same as B. 28. The cuspids are always included in the **retruding** Contour Apparatus as the great force exerted by the power bow would cause it to press into the gum. See **Ap. 83**.

Bicuspids

BICUSPID BANDS

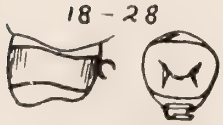
22 - 32



No. 50

Band 50.— Open tube attachment for an alignment bow 22. See **Ap. 3**.

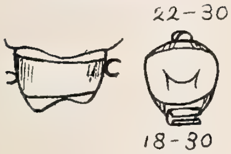
18 - 28



No. 51

Band 51.— Open tube attachment for a lingual bar No. 18. Lingual open tubes when used only as rests for bars or other tubes should be thin and finished to present the least possible edge prominence to the tongue. The tube should be posed with the open joint slightly toward the occlusal plane. See **Ap. 57**.

Bicuspids

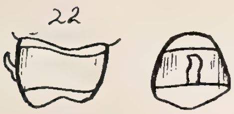


No. 51½

Band 51½.— Same as B. 51 with the addition of an alignment bow attachment. See **Ap. 46.**

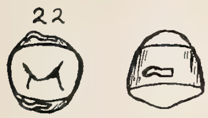
No. 52

Band 52.— The Matteson ribbon attachment. See **B. 10 and Ap. 6.**



No. 53

Band 53.— Buccal hook attachment for an alignment bow. See **Ap. 77.**

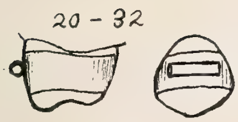


No. 54

Band 54.— Buccal and lingual hook attachments designed to be used with the retruding apparatus for retruding the first bicuspid with elastics where the second bicuspid has been extracted. See **Ap. 74.**

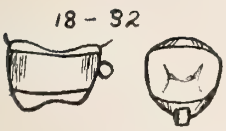
No. 55

Band 55.— The Angle pin-head attachment. The drawing should also show a buccal open tube attachment.



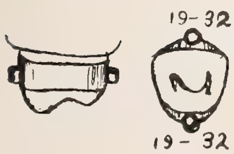
No. 56

Band 56.— Buccal tube, designed to be used instead of the molar anchorage where the bicuspid is bucco-distally malturned. In assembling the apparatus the bow is attached on the principle of a rotating bar. It is especially useful where slight rotation is required, but its action should be carefully watched and controlled. It is useful, also, for short buccal or lingual push bars to the front teeth to open space for the cuspids, used in **Ap. 10 or 11.** Again, to take the place of **B. 65 in Ap. 68.**



No. 57

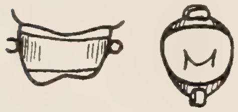
Band 57.— Short lingual tube attachment for a traction bar or jack. This is very useful for a variety of malpositions of the bicuspids.



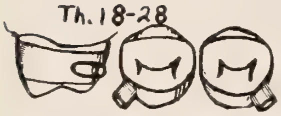
No. 58

Band 58.— Buccal and lingual short tube attachments designed for rotating the bicuspids with pull and push bars from a molar anchorage. See **Ap. 29.** This is particularly useful for rotating the first upper bicuspids whose roots are bifurcated. The band can also be used for a general distal or mesial movement.

Bicuspids

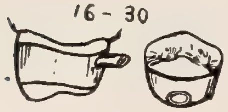

No. 59

Band 59.— Short lingual tube and open buccal tube, designed to be used with the headgear apparatus for retruding the back teeth, the force being applied directly to the bicuspids. See **Ap. 70.** The bands can also be used to attach a lingual traction jack or the bar of a reciprocating jack.



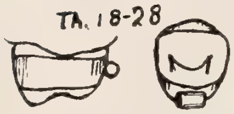
No. 60

Band 60.— Threaded tube for the attachment of a No. 18 bar to act as a movable anchorage to retrude the bicuspids through the reaction of the force of a screw jack for protruding the front teeth. See **Ap. 20.**



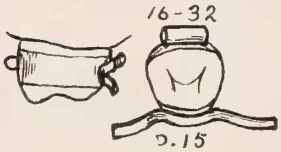
No. 61

Band 61.— Elliptical tube attachment for a spade end jack-bar rest No. 18 or 16.



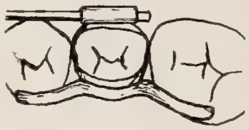
No. 62

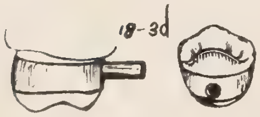
Band 62.—Threaded tube attachment for expanding or traction bar.



No. 63

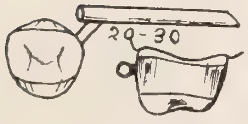
Band 63.— Buccal tube attachment and lingual yoke designed to be used with a spring expanding bow No. 16 or 18. See **Ap. 43.** The yoke is made of No. 16 hook wire, as shown in the accompanying drawing.


No. 63

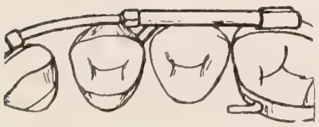


No. 64

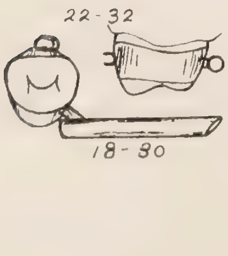
Band 64.— Long tube rest for the bar of a reciprocating jack. See **Ap. 28.**



No. 65

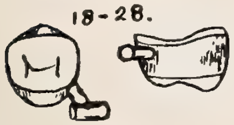


Band 65.—Movable bicuspid anchorage attachment especially useful for the general enlargement of the arch and opening space for the eruption of cuspids. See **Ap. 66.** The peculiar relations of the T attachment to the band at a point as near as possible to the axial line of its movement, as shown in the accompanying drawing, prevents rotation and is favorable to inclination movement in retruding the bicuspids. The distal relation of the mesial end of the tube permits the use of a longer jack-bar than would be possible with the tube soldered directly to the buccal surface of the band.

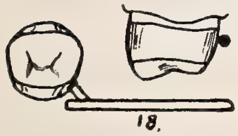


Band 66.— Same as B. 65 for a lingual bow with the addition of a buccal open tube for an alignment wire. See **Ap. 69.**

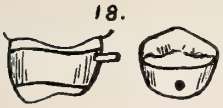
Bicuspids



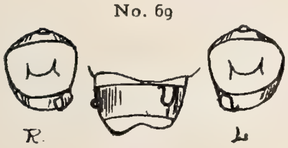
No. 67



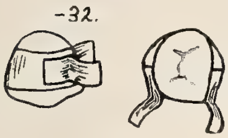
No. 68



No. 69

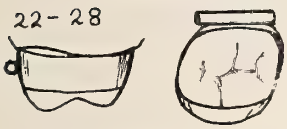


No. 70

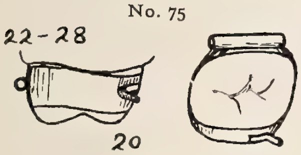


No. 71

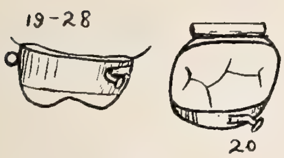
Molars



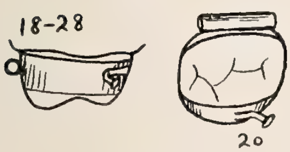
No. 75



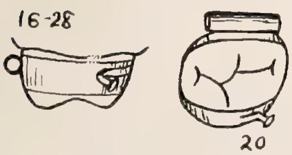
No. 76



No. 77



No. 78



No. 79

Band 67.—Same as B. 66 but with the tube shortened. See **Ap. 67.**

Band 68.—Movable anchorage attachment, using a bar instead of a tube to engage with short jacks at its mesial end, designed to be used where the bicuspid region requires lateral expansion. See **Aps. 71 and 72.** With the lingual tube attachment, lateral expansion would not be possible during the antero-posterior enlargement of the arch.

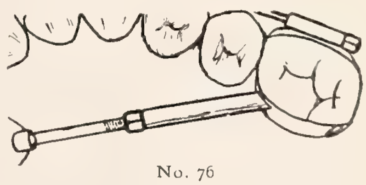
Band 69.— Pin rest attachment for a screw jack.

Band 70.— Button attachment for ribbon traction bar or reciprocating jacks. See B. 19 and **Ap. 30.**

Band 71.— Reinforcement attachments for stationary anchorage. See **Ap. 75** and Chap. IV. The reinforcement extensions are made of No. 32 band material shaped and soldered as shown in the drawing.

MOLAR BANDS

Bands 75, 76, 77, 78, and 79.— Buccal anchorage tube attachments for alignment and traction arch bows. The bands differ from each other in the size of the tubes and the lingual hook and spur attachments shown in the drawings.

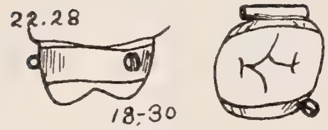


No. 76

The drawings represent the right molars with the spur and pin-head attachments on the linguo-mesial aspect, at which position the spur may act as a jack rest as shown on the right. When it is desired that they act as hooks for elastics, these bands should be placed on the left molars.

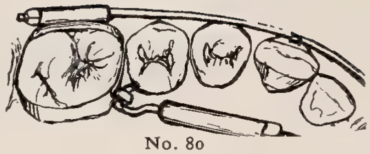
When employed to form stationary anchorages they are united to Bands 71, or 93, or 94, as described in Chapter XXVII.

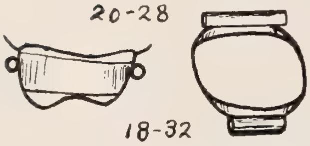
Molars



No. 80

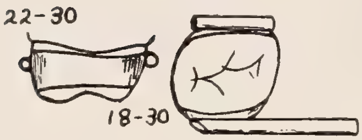
Band 80.— Buccal anchorage tube attachment with short lingual tube for a traction jack. See drawing.


No. 80



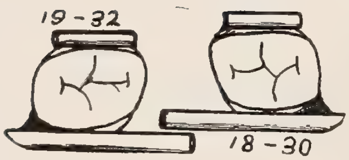
No. 81

Band 81.— Same as above with lingual tube attachment for a bar rest, etc. See **Aps. 47 and 71.**



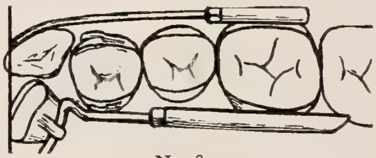
No. 82

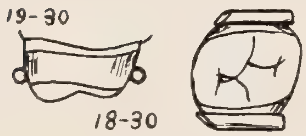
Band 82.— Same as above with a long tube attachment for a lingual bow or bar where great rigidity is required to sustain a single band anchorage and prevent inclination movement. See **Aps. 9 and 15.**



No. 83

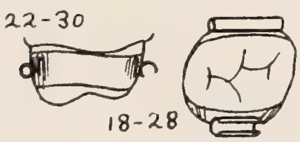
Band 83.— Same as above with a lingual movable anchorage attachment for retruding the molars. The lingual tube is soldered to the extreme disto-lingual angle and thus permits a hinge movement for the purpose of fully utilizing the reaction force of a protruding jack or bow in a retruding inclination movement of the molar. See drawing, and **Ap. 19.**


No. 83



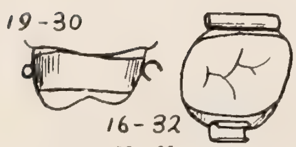
No. 84

Band 84.— Molar anchorage for lingual and buccal protruding or retruding bows or bars.



No. 85

Band 85.— Alignment arch bow anchorage band with open lingual tube rests to support the ends of expanding or contracting bows and jacks. See **Aps. 54 and 56.** In soldering the lingual attachments the joints should be quite occlusally disposed.



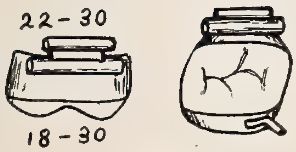
No. 86

Band 86.— Same as 85 with larger tubes designed to be used with the bicuspid movable anchorage. See **Ap. 69.**


No. 87

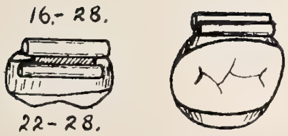
Band 87.— Buccal open tube rest for the bicuspid movable anchorage. See **Ap. 66.** The lingual pinhead attachment can be used for a hook for a rubber band, or a jack rest.

Molars



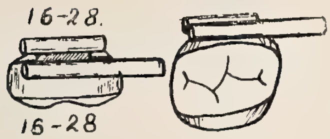
No. 88

Band 88.— Double buccal tube anchorage bands. See **Ap. 77.** All anchorage bands that are designed to sustain considerable force should be reinforced by uniting them to adjoining bands (See Anchorage p. 84), and the power tubes soldered as near to the gingival border as the gum will permit, as a mechanical advantage opposed to inclination movement by distributing the force to the roots. To aid in this design, the traction bow tube is soldered to the attached tube. The intervening concavo-concave lift is to allow room for turning the nuts. The upper tube should stand free from the gum.



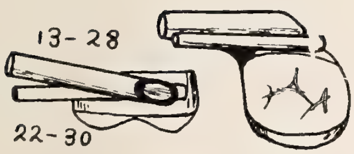
No. 89

Band 89.— Designed for the anchorage band of a protruding contour apparatus of minor power, especially applicable where the two forces are reciprocating and about equal, as in Class II. (See **Ap. 82.**) Its construction is similar to B. 88, except that the larger power tube is placed above.

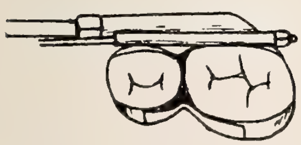


No. 90

Band 90.— Designed for the anchorage of the regular retruding Contour Apparatus. As both the power and fulcrum bows are No. 16 in this apparatus, the tubes are the same size, constructed similarly to B. 89, but with a slight distal convergence to take the required directions of the bows. See **Ap. 83.**

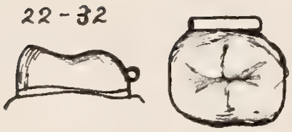


No. 91



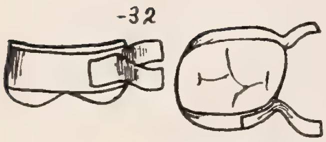
Band 91.— The regular protruding contour anchorage band. See **Aps. 84 and 87.** Solder the fulcrum (or smaller tube) to the band first with No. 2 solder, and then the power tube with No. 3. Place the latter in the exact direction required by the power bow which should go straight — without bend — to the cuspid prominence, hugging the gingival border closely where it curves to engage with the rootwise extensions attached to the incisors. In order to obtain proper direction, the distal end of the power tube will usually rest partly upon the fulcrum tube. The mesial end should stand sufficiently free from the gum over the bicuspid to easily turn the power nut. In the process of seating the power tube, before soldering, file both tubes at their distal contact surfaces so that the distal end of the power tube will hug the appliance as closely as its desired direction will permit. The distal ends of the power tube and bow should not project beyond the fulcrum tube. In finishing, bevel the buccal projections to avoid irritating the mucous membrane.

MOLARS



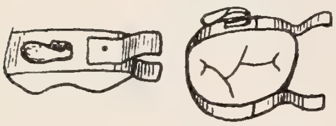
No. 92

Band 92.—**German Silver Crown,** designed to open the bite and support the end of a resilient No. 22 extruding and intruding alignment arch bow. See **Ap. 85.** The ordinary first molar band is contoured and perfectly fitted to the tooth, with overlapping occlusal edges cut away and beveled. An impression of this is taken in investing compound, and luted with a thin solution of plumbago and water, preparatory to making the Mallott's or Babbitt die and counter-die which is used for swaging a No. 28 gauge occlusal cap.



No. 93

Band 93.— Reinforcement anchorage band same as B. 71. See Stationary Anchorage, p. 87 and **Ap. 76.**



No. 94

Band 94.— Same as 93 with the addition of a broad disto-buccal hook for attaching an intermaxillary elastic. See **Ap. 84.**

PART II

Primary Principles of Dental Orthopedia

CHAPTER VI

PRINCIPLES OF MECHANICS IN THE MOVEMENT OF TEETH

In the contemplation of applying force to a tooth for its movement, every condition should be considered: (1) its situation in relation to the arch and adjoining teeth; (2) the number, probable length, shape, and inclination of its roots; (3) the probable yielding quality of its alveolar imbedment in relation to the required movement; (4) the possibility of attaching appliances to the crown which will permit the proper application of force; (5) and finally, the influences of occlusion, dento-facial relations, and the possibilities of retention.

The mechanical processes of correcting malposed teeth may be divided into five **Primary Movements** which, placed according to their degree of demands, are: **Inclination, Rotating, Bodily, Extruding,** and **Intruding.** The movements which are most commonly demanded are **Compound Movements** which are made up of two or more of the Primary Movements.

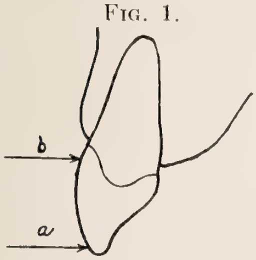
INCLINATION MOVEMENT

Inclination movement in Orthodontia is the most important because it is by far the most common. It also presents a far greater variety of possibilities and demands in the application of force.

In nearly all orthopedic movements of teeth the apical ends of the roots do not move, at least not in the direction of the applied power, unless the apparatus is especially constructed for that purpose, as will be explained later under the head of Bodily Movement. Therefore, while nearly all movements are produced by forcing the occlusal end of the tooth along the arc of a circle whose pivotal point is near the apex of the root, it usually is eminently desirable that the movement be kept at a minimum of its inclination tendency, in order that the teeth when properly aligned will stand in normal pose.

When a pull or push force is applied to the crown of a tooth at any point whose line of direction is at right angles to its central axis, the movement that takes place will be purely that of **Inclination,** providing that perfect freedom of movement is permitted at the point of applied power.

Fig. 1.



When force is applied in this way to the incisal zone "a," Fig. 1, of a tooth, far less power is required for its movement, with a greater tendency toward inclination, than if applied

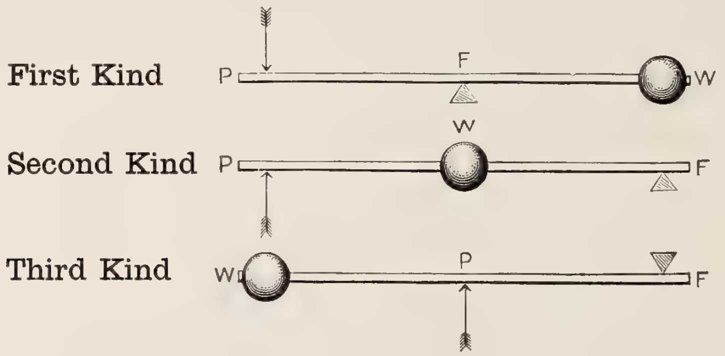
at the gingival zone "b" or at any point further root-wise. There will also be a greater tendency toward a movement of the apical zone in the opposite direction. By this example it will be seen that a tooth imbedded in a yielding medium which forms its socket, and subjected to force appliances attached to its crown for its movement, is practically a lever, responding approximately to the same laws which govern levers everywhere under like conditions of stress.

Levers

The ordinary mechanical lever is **a rigid bar, or inflexible rod, straight or bent, resting upon a prop called a fulcrum, and with power and weight disposed at some two other points.**

The different ways in which the three factors, **power, weight,** and **fulcrum,** may be disposed give rise to three kinds of levers. See Fig. 2.

Fig. 2.



In mechanics the important factors of levers are **power** and **weight** and the **lengths** of **power** and **weight-arms.**

Given three of these factors, the other can always be determined by the following rule which applies to all true levers:

Law of Levers.— Power and weight are in the inverse ratio to their distance from the fulcrum.

The distance from the fulcrum at which power and weight are placed indicates the lengths of the power and weight-arms respectively. If we wish to know, for example, how much power will be required with a 6-foot lever of the "**first kind**" to sustain a weight of 25 pounds, with the **fulcrum** placed one foot from the **weight,** we have but to state the inverse ratio as follows:—Power-arm (5) is to Weight-arm (1) as Weight (25) is to Power (x) or

$$5 : 1 :: 25 : x. \quad \text{Ans. 5 pounds.}$$

Again, how much weight will 5 pounds of **power** lift with a 6-foot lever of the "**second kind,**" with the **weight** placed one foot from the **fulcrum?**

Weight-arm (1) is to Power-arm (6) as Power (5) is to Weight (x) or

$$1 : 6 :: 5 : x. \quad \text{Ans. 30 pounds. Etc.}$$

Levers in Relation to Laterally Moved Teeth

Physics in computing quantities deals only with **power** and **weight** or work, exemplified in the above general law of levers. Little is said of the force of reaction, or the force sustained at the **fulcrum**; whereas with a **tooth**, considered as a lever, the action at **fulcrum**, as will be shown, is quite as important to us as that exerted at the points known as **power** and **weight**; and, moreover, it is important to keep in mind approximately the relation which this force bears to the other factors. While it is never possible or necessary to calculate these quantities accurately, still, in order to arrive at the rough estimate desirable, a clear conception of the mathematical methods employed under the laws of physics, especially those relating to levers, is very important. This can easily be approximated with levers when we remember another law of levers, i. e.:— **Force exerted or sustained by the middle factor of a lever at equilibrium, be it fulcrum, weight, or power, is equal to the sum of the other two factors.** This law shows why a lever of the second kind is always chosen where great force is required at the expense of motion.

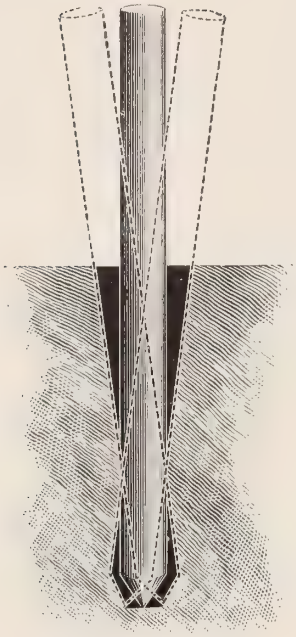
Again, in the typical lever the **fulcrum** is always considered a fixed point, but we are aware there are a number of implements employed in mechanics that exert force according to the principles of levers, though in construction they differ in certain particulars from every one of the three kinds. Common examples of this are all forms of the **pulley** and the **wheel** and **axle** power.

Fulcrum and Weight Interchangeable.— There is, furthermore, a not uncommon kind of lever in which points of weight and fulcrum, in their activities upon each other, are more or less interchangeable — each acting as a fulcrum for the other, with varying stability and relative energy, governed by the velocity of the moving power and the relative length of the power-arm.

An example of a lever of this kind is an oar of a row-boat. In proportion to the velocity of the moving power exerted by the rower, above the possibilities of the water to get out of the way of the blade, the oar becomes a lever of the **second kind** and the boat or work moves forward. But if the velocity of the moving power is not sufficient to overcome the inertia of the boat, the only work that the oar or lever can be said to accomplish is the movement of the yielding water in front of the blade, with fulcrum at the oarlock — or the action of a lever of the **first kind.** It can be seen in this common example of a lever of the second kind that the fulcrum, or so-called point of resistance, is a broad moving area of water. And it would be none the less a lever if its so-called point of work was also spread over a broadened area upon the lever, both areas of fulcrum and weight moving and reacting upon each other.

This combination of activities is exactly that which is exemplified in the alveolus of a tooth when force is applied in a lateral direction upon the crown. It is perfectly illustrated also in the following example of the post lever.

FIG. 3.



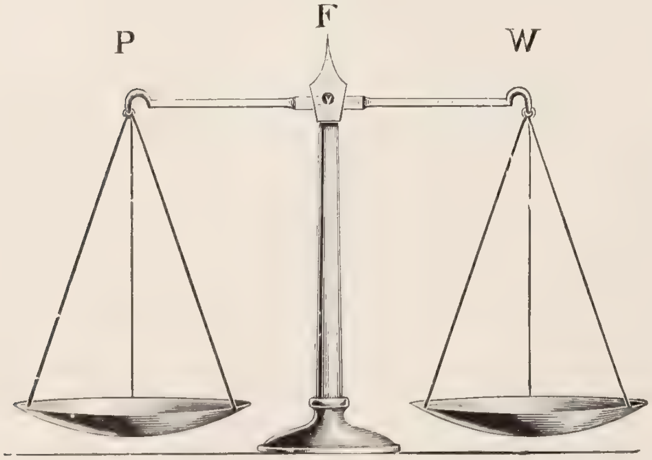
Post Lever

If you should drive a four-foot post one-half its length into clayey soil of uniform quality, and then take hold of the top of the post and move it back and forth with a view of subsequently pulling it out of the ground, you would be working a lever which combines the qualities of the first and second kinds, or one like the oar in which the so-called areas of fulcrum and weight act as fulcrums to the other. See Fig. 3. After pulling the post out of the ground, if it were possible for you to make a transverse section of the soil for the purpose of examining the shape of the hole you had made, you would find it somewhat the shape of an hour-glass; the upper portion of the opening being about twice as large as the lower.*

As the post is forced in one direction the soil in front of it, along its upper sphere of action, will become impacted, or thrust to one side, the post thus acting as a lever of the second kind, with fulcrum at the lower end. At some point along its imbedded length, however, it will cease to move in the direction of the applied power, because the resistance of the soil in the upper area causes it, in turn, to act as a fulcrum, and the whole as a lever of the first kind, with work or movement at the lower end in the opposite direction.

The reason that the upper area of work is about twice that of the lower in the above example, and also the changed relations with **power** applied at different points, may be found in an examination of other examples which refer to the relation of the three factors of levers.

FIG. 4.

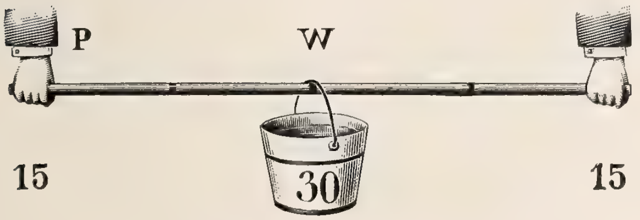


Levers of the First Kind.— The beam of balance scales is a lever of the first kind. The support or central standard is the fulcrum, with points of power and weight at the end attachments for the pans. See Fig. 4. It can now be seen at once that when the beam or lever is at equilibrium the fulcrum sustains the sum of power and weight, and this would hold true of any lever of the first kind at whatever intermediate point between power

*In mathematical exactness, a post moved in this way, with its imbedded portion completely surrounded with a homogeneous resisting medium, the depth of the upper V-shaped opening would be somewhat less than two-thirds the entire depth of the hole.

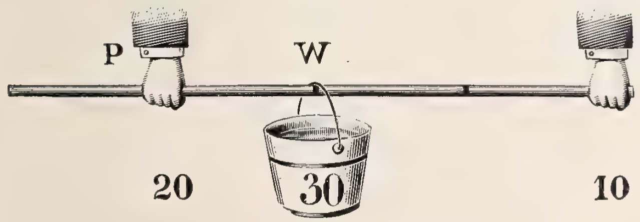
and weight the fulcrum is placed. Therefore when the fulcrum is exactly in the middle of the lever of the first kind, at equilibrium, it receives twice as much stress as that exerted at the point of weight; and for this same reason the post lever moves through the soil at the surface of the ground about twice as far as at the lower end in the opposite direction.

Fig. 5.



Levers of the Second Kind.—An example of a lever of the second kind may be a rod or a pole supporting a weight carried by two men. See Fig. 5. If the points are four feet apart, at which the two men—whom we may call P and F—grasp the pole, and the weight is a pail of water weighing thirty pounds swung in the center of the pole, each man would exert a force equal to fifteen pounds. In other words, the force exerted at W exactly in the middle of a lever at equilibrium would be twice that at the fulcrum. Here, again, we have the same result as shown by the action of a lever of the first kind.

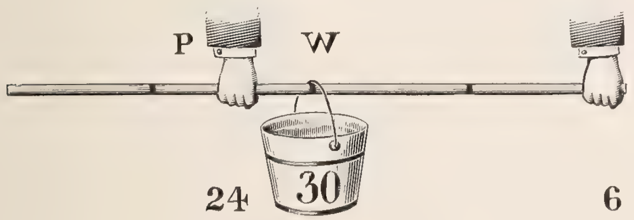
Fig. 6.



Now, if you please, note the change in the relative magnitude of force exerted at fulcrum and weight when the length of the power arm is shortened. See Fig. 6. If P grasps the rod one foot from the pail, we have a three-foot lever with P exerting twice as much force as F, which may be proven by the law of levers, i. e., "Power and weight are in the inverse ratio to their distance from the fulcrum."

Power arm of the above lever (3 feet) is to W arm (2 feet) as weight (30 pounds) is to P, or 20 pounds; which leaves 10 pounds to be sustained by F. Therefore the force exerted at weight in this lever is three times that at the fulcrum.

Fig. 7.



Again, if P grasps the rod six inches from the weight, he exerts a force equal to four times that of F—determined by the same law. See Fig. 7. Here the force exerted at weight is five times that at the fulcrum.

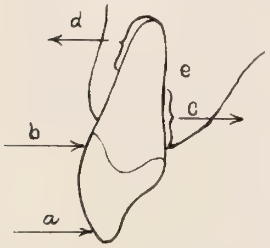
When we apply these rules to our post lever (which I have chosen to illustrate on a general scale the action of the same character of force applied to a tooth) we can see that the inverted V-shaped opening, caused by the lower end of the post moving in the opposite direction from the applied power, may be changed quite decidedly in area by applying the power at different points along that portion of

the post above the surface. For instance, when power is applied at the top of a four-foot post imbedded one-half its length in the ground, the movement at the lower end in the opposite direction will be about one-half that at the surface of the ground in the direction of the power. When power is applied one foot from the ground, or at a point one-half the length of the exposed end, the movement at the lower end will be about one-third that at the surface, and when applied six inches from the ground (or in a tooth lever, as near to the alveolar margin as the gum will permit) the movement at the lower end will be about one-fifth that at the surface.

Tooth Levers

Teeth as Levers.— While teeth differ in shape from each and from the post lever I have described, and while their alveolar surroundings do not present a uniformity of resistance to their movement, and therefore while we cannot calculate force and motion with mathematical accuracy, still the fact that they are imbedded one-half their length in a yielding substance and subject to the frequent application of force for the correction of irregularities, the only way by which we can approach an exact science in the application of power for their movement is to consider them as levers propelled by a machine doing work on the tissues in which they are imbedded.

Fig. 8.



In the process of moving a tooth by inclination there are two principal spheres of resistance in the socket, i. e., one over that portion of the wall that is pressed upon by the tendency of the root to move in the direction of the applied force "c," Fig. 8, and the other upon the opposite wall at the apical area, that is pressed upon by the tendency of that portion of the root to move in the opposite direction "d." Within the boundaries of these two spheres of action the force exerted upon the resisting surfaces gradually diminishes as they approach each other until a certain zone, or pivotal point "e," is reached upon which it may be said no force is exerted in either direction and consequently no movement occurs toward or from the direction of the applied power. By far the greater portion of the force is expended at the gingival and apical boundaries of these two spheres, which therefore may be considered as the true points of Fulcrum and Weight in our somewhat hypothetical tooth lever.

Tooth Levers of the Second Kind.— With the application of inclination force at any point upon the crown, the apical area of the alveolus is the natural fulcrum or immovable point, and the gingival area that of weight or movement. A tooth is therefore naturally a lever of the **second kind**. One of the reasons for this is due to the greater relative stability of the apical walls of the sockets, especially of long roots which penetrate the real bone. But the principal reason which applies to all conditions and is determined by the law of levers is, with force applied

laterally at a single point upon the crown, only one-half to one-fourth the amount of power can be exerted in this way at the apical area as compared to that of the cervical.

When retruding force is applied at the incisal zone — "a," Fig. 8 — of a central incisor, about one-half as much power is exerted in the opposite direction upon the alveolus at the apical sphere of its influence "d" as at the cervical "c"; and if applied at the gingival zone of the crown the force in the opposite direction at "d" is greatly decreased. Consequently the apical end is naturally the fulcrum or immovable point. On the other hand, in proportion to the resistance at the alveolar border "c," this point also becomes a fulcrum with tendency to move the apical end of the root in the opposite direction.

The said spheres of action — apical and cervical — of a tooth lever under the influence of inclination force applied to the crown are both therefore fulcrums, reacting upon each for the production of weight, work, or movement, proportionate to the conditions.

Relations of Power, Stress, and Movement

The relative degree of force exerted at these spheres of action is largely governed by the position upon the crown or root at which power is applied; while the actual movement that takes place is further governed by the relative stability of the resisting spheres, form and number of the roots, etc.

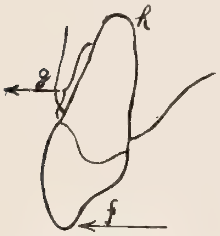
If a tooth (say a central incisor) were a true lever of the first kind with its point of immovable fulcrum at the border of the alveolus and its point of weight, work, or movement at the apex; or again, a lever of the second kind with its immovable fulcrum at the apex, and point of weight at the alveolar border; and both with the same possibilities of changing the length of the power-arm presented by the different points upon the crown at which force can be applied, its relation of applied forces could be determined with mathematical precision, as follows:—With power applied at the incisal zone, the amount of force exerted at the apex in the opposite direction, in either case, would be exactly one-half that at the alveolar border, providing that the latter was equally distant from the other two factors, or exactly in the center of the lever; and with power applied at the gingival border of the crown, or upon the so-called power-arm at one-fourth the same distance from the central factor of the lever, the force exerted at the apex would be exactly one-fifth that at the alveolar border; as proven by the examples of the pail and lever of the second kind.

When applied to inclination movement, this law of levers teaches us why we obtain a more ready response to force that is applied at or near the occlusal borders; but with a far greater tendency toward tipping or abnormal inclination of the crown than if applied at or above the gingival margins. To illustrate this, note the different movements that would probably take place in

a central incisor by applying force at different points and directions upon the crown, as follows:—

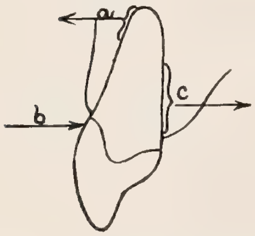
With retruding power applied at "a," Fig. 8, the relative amount of force exerted at "c" compared to that at "d" would be as two to one. But if the usual stability of the cortical surface of the process obtains at "c," quite as much movement might occur at "d" in the opposite direction; and in either event a minimum amount of power would produce inclination movement. This example fairly represents the activities of a lever of the first kind.

Fig. 9.



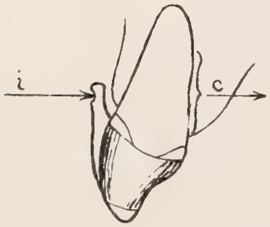
With protruding power applied in the opposite direction, at "f," Fig. 9, the relative stability of the resisting spheres would be reversed, and, according to the law, as the force exerted at "**g**" (or "**c**") would be about twice that at "**h**," (or "**d**,") with the present example the apical sphere of resistance "**h**" would be the real fulcrum, with almost if not quite the entire movement at "**g**," and the lever that of the **second kind.** In both these examples a minimum amount of power would produce inclination movement.

Fig. 10.



With retruding power applied at "b," Fig. 10, the relative amount of force exerted at "c" compared to that at "a" would be as five to one, and even greater in some instances, in proportion as the line of force approached the center of resistance. With this example there would be far less tendency toward inclination movement because the main portion of the power would be distributed to the posterior wall of the alveolus. The fact also that it requires far more power at this point, and above, to move the tooth is of the greatest importance in the construction of stationary anchorages.

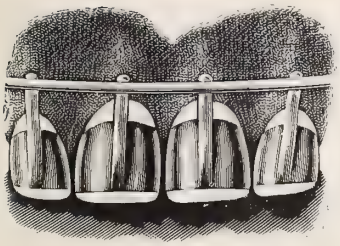
Fig. 11.



Approaching a Bodily Movement.— With power applied above the point "b" at "i," Fig. 11, as could be accomplished by attaching to the crown a rigid extension or bar, the line of force might be sufficiently above the point of greatest resistance at "c," to exert no force in the opposite direction at the apical sphere. In fact a more or less bodily movement of the entire root in the direction of the force would probably occur in some instances, though not with the absolute certainty that would follow the more scientific application of force for this character of movement, described later. For instance, in the construction of an appliance for the retrusion or retraction of the incisors with a traction bow extending from molar anchorages, if we wish the least movement possible of the roots in the opposite direction, the bow should rest upon the incisors as near to the gingival margins as the gums will permit. I usually solder to the bands upright bars which extend to the highest points of the exposed faces of the crowns. Grooves or rests are

Fig. 12.

FIG. 13.



cut at the upper ends of these for the bow, enabling it to span the interproximate gingivæ. See Figs. 12 and 13. I frequently extend the bars above the gum margins, in order to apply power that is equivalent to direct force upon the roots at points above the margins of the alveoli, and I find these procedures of the greatest importance in arriving at results for which they are designed.

It is not necessary to multiply descriptions of methods relative to other teeth and conditions where the important principles of inclination movements may be employed, further than to say that whenever it is desired to avoid producing an abnormal inclination of the crowns of teeth in the direction of the applied power, it is nearly always possible to take advantage of some effective mechanical principle. On the other hand, whenever in the movement of a crown under the application of a single force, it is desired to move the root in the opposite direction, the force should be applied as near as possible to the occluding border. This is especially true in cases of protruding crowns of the superior incisors, with a retrusion of the roots; of which the common cause is thumb-sucking — the teeth often assuming a decided labial inclination, with the production of a depression along the upper portion of the upper lip.

Power in Relation to the Possibilities of Movement

It has been shown that the tendency to **inclination movement** or tipping of teeth is somewhat in proportion to the nearness to the occlusal zone at which power is applied. There is another cause of the tipping movement that is too frequently overlooked, i. e., **power applied in excess of the possibilities of orthopedic movement.**

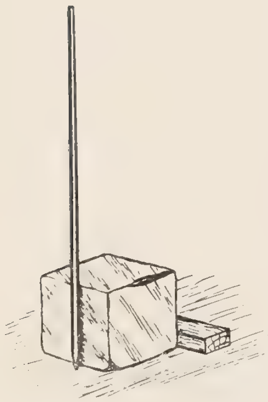
In correcting the positions of malposed teeth it should never be forgotten: first, that the important and indispensable part of the operation is to so regulate the force that the normal functions and healthful conditions of the teeth and surrounding tissues are preserved; and secondly that nature will permit their movement, physiologically, only so rapidly as she is able to take care of the broken-down tissue of retrogressive metamorphosis caused by pressure of the tooth upon the walls of the alveolar socket. The rapidity of the movement will be influenced largely by the age of the patient, and will differ as other things differ with people.

The point which interests us may be stated as follows: As soon as the applied force overreaches the possibilities of natural physiologic changes, the surplus is liable to spend itself in producing some undesired and unlooked-for condition. In other words, nature can be made to work only so rapidly. Any attempt to force her beyond her natural powers will result — if not in disaster — certainly in a misdirection, and transference of the surplus force to other parts which should not, and would not, otherwise be disturbed.

On account of the relatively hard surface layer of alveolar process, there is always a tendency for it to act as a fulcrum over which the tooth is tipped; but fortunately the apical region of bone in which the roots are imbedded usually presents sufficient resistance to the lessened degree of force at this point for it to remain as the true and immovable fulcrum of the lever so long as the force is not increased beyond the powers of resorption in other portions of the socket. The moment this does occur, however, the peripheral surface of the alveolus becomes the fulcrum, while the extra force is delivered at the end of the root in the opposite direction and in exact proportion to the surplus force.

As before mentioned, notice the action of the force of an oar in propelling a boat in still water. If only sufficient pressure is used against the oar to permit the water to pass from in front of the slow-moving blade, there will not be sufficient pressure at the fulcrum, or oarlock, to overcome the inertia of the boat; but immediately upon the force being increased above the possibilities of the water to get out of the way, the fulcrum of the lever is transferred to the water and the over-load of surplus force is delivered at the oarlock with a movement of the boat. Let me give another and perhaps more forcible example:—Drop the point of a crow-bar into the ground at the side of a large cake of ice, fixed immovably in place. See Fig. 14. Now if we heat the bar and press it against the cake with only sufficient force to permit the ice to melt in front of it, little or no change of position will take place at the point or fulcrum of the bar, but the moment we increase the pressure above the melting possibilities of the ice, the fulcrum of the lever is transferred to the cake and the surplus force is delivered at the point of the bar, with a tendency in proportion to the surplus pressure to force it laterally in an opposite direction in the ground. This illustration is only one of many conditions which may and often are produced by excessive or misapplied force in operations for correcting irregularities of the teeth.*

Fig. 14.



In a desire to hasten an operation, dentists will commonly push the amount of force to the limit, not fully realizing the fact that the orthopedic movement of the teeth, within the bounds of physiologic safety, cannot be made to move faster than the processes of nature will permit, however much force is exerted. With force properly applied near the gingival borders of the teeth, they will usually move by inclination, but with no appreciable movement of the ends of the roots in the opposite direction. When, however, the magnitude of power is in excess of the requirements of the most rapid possible movements at the cervical sphere of action, it reacts upon the apical sphere with perhaps the production of movement in the opposite direction with far greater inclination: which would not have occurred had the power been kept within the bounds of the possibilities of

* Case—Dental Review, August, 1892.

the movement desired. In other words, the cervical sphere of action being unable to respond by proportionate movement to more than a certain degree of power, becomes in turn a real fulcrum which causes movement at the apical end. This principle of force is important when applied to teeth which are moved by virtue of the limited possibilities of the alveolar process "to get out of the way," and it is also applicable between all alveolar spheres of action and fulcrum; as for instance the general movement of teeth from dental anchorages. See Stationary Anchorages, Chapter VII.

The above examples are presented to illustrate that the force exerted at different areas of the alveoli with power applied at different points upon the crown is quite similar to that of true levers; but that the actual movement that is produced is often far from that which would obtain under the exact conditions and requirements of mechanics. The difference being caused: *first*, by the fact that the power cannot be exerted in the socket at two exact points of weight and fulcrum, but instead, upon the broadened spheres of the alveolar process which is pressed upon by the roots of the teeth under the influence of force appliances attached to the crowns: *second*, by the variability of the resisting spheres; and *third*, by the peculiar quality of the alveolar process to move only in accord with its physiological possibilities, which frequently results in the transference of the force of action to points of reaction.

Furthermore, these principles and activities of force are quite as applicable in the movement of any of the teeth, and especially important, as it is always possible with a little careful thought and management to approximate and control the relative variability of probable movement at the resisting spheres.

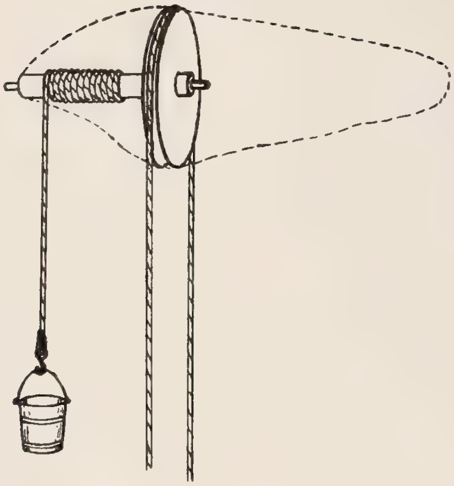
ROTATING MOVEMENT

One of the most common forms of dental malposition is that of mal-turned teeth. It enters more or less into every class of irregularity, particularly that of the simple and complex division. There are a number of effective methods of correction, applicable to different conditions, which are treated at some length in Group III, where the several appliances are shown with full description of their respective force activities. There are certain important principles in the application of force for the rotation of teeth which it would be well to remember.

Wherever force is applied for the rotation of a tooth, the mechanical power of the appliance is dependent largely upon the distance from the central axis at which the force is exerted. This is quite important when applied to the labial teeth, the peripheral surfaces of whose crowns present points of attachment that greatly differ from each other in this regard.

The action of the "wheel and axle" as one of the secondary mechanical powers

Fig. 15.



will serve to illustrate this principle. Fig. 15 demonstrates at a glance the mechanical advantage of applying a rotating force at the gingival margins of incisors and cuspids. This principle is especially true of the spring lever rotator, which is one of the most convenient and effective appliances in the Author's practice for nearly all cases where a moderate force is sufficient. See **Aps. 26 and 27.**

Spring Lever Rotator.— When a straight resilient bar is bent in the form of a bow and its ends are immovably attached, the only force which it potentially exerts is in the direction of the arcs which its ends would inscribe if released and allowed to return to equilibrium. See Fig. 16.

Fig. 16.

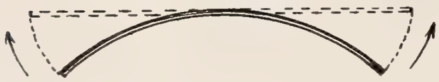
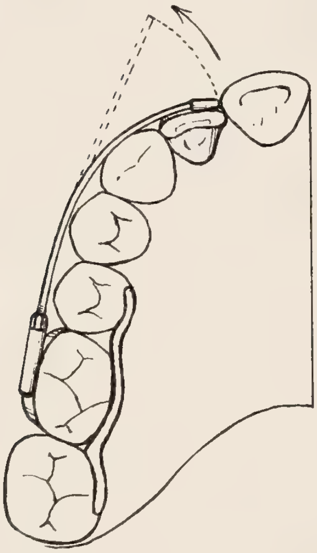
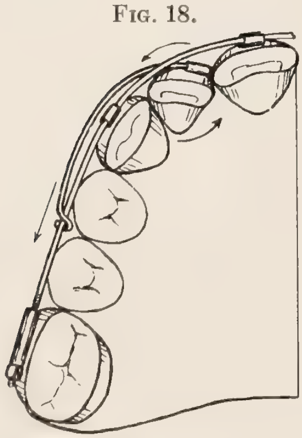


Fig. 17.



If one end is fastened to a stationary point or anchorage and the other to a movable body, such as an incisor tooth, the only force which it would exert upon the incisor would be in the direction of the arc which that end would inscribe in returning to the originally straight form of the bar, as shown in Fig. 17.

Fig. 18.



If instead, the distal end is hooked to an alignment bow along which it can freely glide, as in Fig. 18, the bar will then exert the additional force of tooth rotation. See **Ap. 27.** If the incisor is prevented by the alignment bow from responding to the outward spring of the end of the bar to which it is attached, the only movement of the tooth will be that of rotation on its central axis, in response to the force of the bar to return to equilibrium; and this force will always be in proportion to the freedom given to the bar to straighten itself by the distal end gliding along its attachment. Therefore to obtain the greatest rotating power of a spring lever rotator, the free end should not be clasped by a tube

attachment, as shown by the drawings in **Ap. 26,** nor by any long-bearing attachment, as the friction caused by the spring of the bar would retard its rotating movement.

In all cases where this appliance is employed, an alignment arch bow is indispensable to prevent the rotating tooth from being forced out of alignment. The bow is also well adapted for the gliding movement of the free end of the rotating lever, with a proper distribution of its tangentical force. Frequently the reciprocally reacting force exerted by a spring lever can be utilized in bringing the tooth or teeth to which it is attached at one end, or both, into alignment, as shown under **Ap. 26.** But no patient should be allowed to leave the chair with appliances of this kind attached to the teeth, without the controlling power of an alignment bow or other effective attachments for preventing the teeth from being forced out of alignment.

Whenever a single rotating force is applied upon one side of a tooth, as with levers, ligatures, pull and push screw-bars, etc., there is also the tendency toward inclination movement unless prevented by an arch alignment bow or other means. Frequently both movements are demanded, i. e., the rotation of a tooth while forcing it to alignment. Numerous instances will be shown in the illustrations of **Specific Methods** where this principle is taken advantage of.

True rotating force which exerts no tendency other than to rotate the tooth upon its central axis, can only be produced by reciprocally acting pull and push forces applied upon opposite sides of the tooth. This principle is applicable in all cases where considerable force is demanded and frequently it is the only effective method. The appliances in **Aps. 28 to 34** inclusive, with the text descriptions, so perfectly illustrate this principle that it need not be explained here.

BODILY MOVEMENT

Many fail to understand or appreciate the mechanical requirements necessary for the bodily movement of teeth. For instance, we frequently see in print the assertion that molar teeth are moved bodily through the process with the propelling force of pull or push bars or bows resting in tubes soldered to the buccal surfaces of single molar clamp bands; and other statements relative to the bodily movement of teeth that are even more improbable with the inadequate methods proposed.

With very rare exceptions, lateral force applied at a **single point** upon the crowns of any of the teeth and especially that of the molars, would require for the movement of the roots in the direction of the applied power a far more rigid propelling arm and grasp of the crown than is possible with all ordinary methods produced by regulating appliances. The limited area upon which force can be

applied to a tooth, compared to that portion imbedded in the socket and covered by the gum, has made it next to impossible to move the apical end of the root in the direction of the applied power. Nor could this ever be accomplished with power applied in the usual way at any one point upon the crown, however near the gingival margin; as the opposing wall of the alveolus, near its margin, would receive the magnitude of this direct force, and in proportion to its resistance it would become a fulcrum exerting a tendency to move the apical end or ends of the roots in the opposite direction.

But if in the construction of the apparatus a **static fulcrum** is created outside of the alveolus and made to act independent of the osseous imbedment at a point near the occluding or incisal end, while the power is applied as far rootwise as permitted, the tooth will then become a lever of the third kind, with all of the power directed to a movement of the entire root in the direction with the line of force. See Figs. 21 and 22. If an attempt were made, by grasping the top of a post imbedded one-half its length in some yielding substance, to move it bodily in a lateral direction, it might be found that the upper portion could be easily moved back and forth; but with every movement the lower end of the post would move in its imbedment in the opposite direction. See Fig. 3. If instead, the post were grasped near the ground far more force would be required to move it, and though with an increased advantage to move it bodily, great strength of grasp would be required to prevent the lower end from still moving in the opposite direction. If now the top of the post is grasped by one hand and prevented from tipping, while the whole force of the other is exerted at the base, the difficulty will at once be solved. In the last effort an independent fulcrum is established at the top of the post and the whole mechanical action changed to that of a lever of the third kind, with the entire power distributed to all the imbedded portion towards a movement in the direction of the force. It is exactly this principle that should be employed for the bodily movement of all teeth. When it is possible to apply the power at a point further root-wise than the gingival border through the medium of a rootwise bar soldered to the band, or a rigid extension of the band attachment, the mechanical advantage of the lever will be increased and the force upon the artificially arranged fulcrum proportionately lessened.

In the operation of bodily protruding or retruding the incisors in phalanx, where this principle is applicable for the correction of facial contours, the rootwise extensions or upright bars with which the power bow engages are soldered to the labial faces of long-bearing bands. See Construction of Bands, 26, 27, and 28, and **Aps. 83 and 87**.

The foregoing principle of mechanics as applied to bodily tooth movement is further explained by the following diagrams. In Fig. 19, if force is applied at "A" in the direction of the arrow, it will be principally received by the opposing walls of the alveolus near the margin, or at "B," where the greatest, if not the

only movement of the alveolar process would occur, but in proportion to the resistance of the labial wall it will become a fulcrum, creating a tendency to move the

Fig. 19.

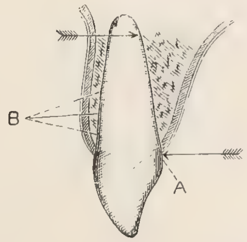
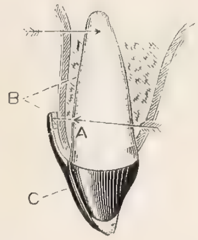


Fig. 20.



apical end in the opposite direction. This would also be true if the power is applied in the direction of the arrow at "A," in Fig. 20, or upon the rigid rootwise extension "C," except that it would be distributed over a greater area of the alveolus with lessened tendency to move the root in the opposite direction. But if in the construction of the apparatus the incisal end is prevented from moving forward or its movement is placed under positive control, it becomes the real fulcrum with possibilities of directing the power towards a bodily movement of the entire root.

Fig. 21.

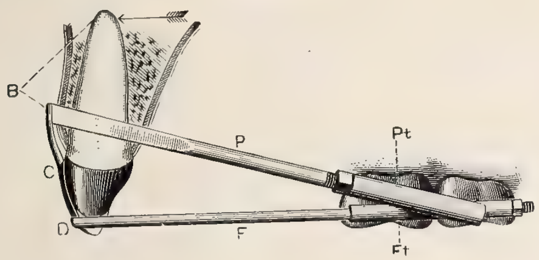


Fig. 22.

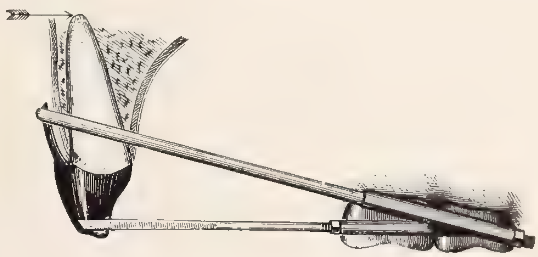


Fig. 21 shows the principles of the combination for a bodily protruding movement of the incisors. See **Aps. 82 and 87,** Classes II. and IV. The power bow "P" exerting a push force of considerable magnitude, should be as large as Nos. 13 or 14, to prevent springing laterally; while the fulcrum "F" exerting a traction force need be no larger than No. 22. The reaction of these two forces from opposite directions, centered in the same anchorage, neutralize each other at this point to the extent of the lesser force. When they are equal or exactly reciprocal no distal or mesial force is exerted at the anchorage.

Fig. 22 shows the combination for bodily retruding the incisors. See **Ap. 83,** Class II. It will be seen that the direction of the two forces is reversed. The power bow now exerting a pull force need not be larger than No. 16; while the fulcrum bow now exerting a push force should usually be as large as No. 16.

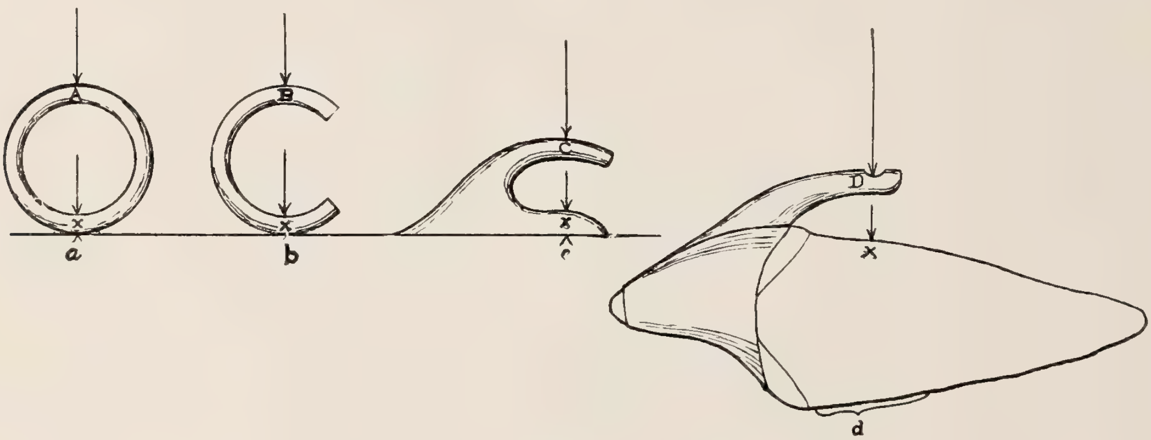
A study of these principles will show that the operator has perfect control over the peculiar character of movement imparted to the incisors. For instance, in Fig. 21, if it is desired to bodily move the incisors forward and retain the same inclination which the teeth possessed at the start, the distal nut of the fulcrum bow should be judiciously unscrewed as the work progresses to allow the

incisal zone to move forward with the roots. The loosening of the fulcrum wire can be carried to the extent that there will be no movement at the apical zone. On the other hand, by exerting a traction force upon the fulcrum bow the apical zone can be protruded and if desired the occlusal zone can be retruded. Similar rules, with movements reversed, are applicable in bodily retruding the incisors with the combination shown in Fig. 22.

In the early introduction of the above principles, which now are probably accepted by most dentists as exactly according to the laws of mechanics, the author was severely criticised and the principle declared false by a number who had not informed themselves upon the subject. The principal contention was that force applied at "B," Fig. 21, was equivalent to applying it at "C," inasmuch as the extension bar was attached at "C" and because the force was applied through this medium. They seemed to forget that one of the basic laws of physics is: **Force always acts in a line with the direction of its movement,** and that this applies equally to all levers, however bent or crooked the arms, providing they be rigid.

Students will recognize the truth of the principle in the following drawings:

Fig. 23.



Force applied at "A," Fig. 23, in the direction of the arrow, upon a rigid steel ring, will be transmitted to "a," and will have the same effect and direction of influence as it would have if applied at "x." This will also be equally as true if a piece is cut out of the ring on one side — providing it is rigid — as at "B-b." This being true, the same principle will apply at "C-c" and "D-d." The latter is similar to the appliances which we rigidly attach to a tooth for the purpose of applying the force in a line further root-wise than would be possible at any point upon the crown proper.

In the combination for bodily moving the teeth, through the possibilities of establishing an independent fulcrum at the occlusal or incisal zone, the only object of applying the power at a point upon the root is to increase the mechanical advantage of the lever, by increasing the length of the power-arm, or the distance from points of power and fulcrum, which proportionately relieves the strain upon

the power and fulcrum bows. This is a feature of considerable importance with regulating apparatus where the greatest possible delicacy of the appliances consistent with strength is always desirable.

INTRUDING AND EXTRUDING MOVEMENTS

When force is applied in the line with the long axis of a tooth, toward the apical end of the root, it tends to produce an **intruding movement.** And when applied in the opposite direction it tends to produce an **extruding movement.** With fully developed roots the intruding movement is far the more difficult because — with the exception of the first action of the force upon the pericemental tissues — the movement is wholly by virtue of resorption of the bone surrounding and forming the alveoli. For this reason also their retention is attended with far less difficulty than extruding movements.

It requires far more force to intrude molars and cuspids than bicuspids and incisors, for reasons which must be evident to every one. The difficulty of an intruding movement also is somewhat in proportion to the age of the tooth. This principle is taken advantage of in the correction of **close bite malocclusions**, Type D, Class III, and whenever the first molars at 12 or 14 years of age are chosen for occluding buttresses to bear the entire force of mastication while the bicuspids and other teeth are extruded to the new occlusal plane; whereas the second molars would be very poor teeth for this purpose.

Extruding Movements are commonly the easiest of all movements of the teeth, and when performed within the bounds of a reasonable application of force there is no danger of rupturing the vessels and nerves at the apical foramina. In this movement the gum rarely if ever changes its relative position at the gingival border, the movement seeming to take place solely by stretching the pericemental and gum tissues. Judging from the difficulty in permanently retaining movements of this character after correction however, we are led to the conclusion that the reformative process in building the new alveoli, under these circumstances is comparatively slow.

The mechanical principles involved in the movements of **Extrusion** and **Intrusion** are fully explained under the several heads which treat of the practical application of apparatus for producing these movements. See Group I, Part IV, and **Aps. 85, 86, 88, and 89,** Part V.

CHAPTER VII

TECHNIC PRINCIPLES OF DENTAL ANCHORAGES

The most important of the laws of force in the mechanical movement of malposed teeth is Newton's third law: — **To every action there is an equal and contrary reaction.**

Nowhere is this law so important as in the application of force in **dental anchorages** and in all movements of teeth from points of dental resistance, because whatever the magnitude of force that is exerted toward the correction of one or more malposed teeth, an equal force must always be exerted in the opposite direction upon the tooth or teeth that are chosen for the bases of action. While the forces exerted at points of action and reaction are always equal, the relative amount of movement that is induced is proportional to the respective resistances.

As the resistance to movement is largely dependent upon the methods employed for the application of force, and consequently upon the peculiar construction of the appliances and their attachments, a perfect knowledge of the principles involved, with the technics of construction and application of dental anchorages, is of the utmost importance.

Bands for anchorage teeth that are intended to sustain considerable force should be made of material no thinner than No. 35; and for stationary anchorages two and sometimes three adjoining bands should be soldered firmly together.

The ordinary clamp band attached to a single molar tooth and also the long band clamping two or more teeth together are not stationary anchorages. In fact, some of them should be termed "movable anchorages" because they offer so little resistance to inclination movement; especially when the bands are thin or are uncemented as is sometimes advised, for even when well supported by the adjoining teeth there is nothing to prevent the sliding of contact surfaces, which is the main principle of anchorage stability.

It may be laid down as a rule, that all single band anchorages of the above type will surely produce an inclination movement of the teeth to which they are attached if much force is applied. A band that is clamped around a tooth with a screw has no superiority in sustaining capacity over one that is accurately fitted, even though the bands be of the same thickness and both cemented; and the claim that "it will move a first molar tooth bodily through the process after the eruption of the second molars, if it moves it at all," is simply absurd. With the most scientifically constructed anchorage, with thick molar bands reinforced and properly supported so as to thoroughly distribute the applied force to all its resisting areas, if the power is applied in the usual way on the crown, the molar teeth

to which the anchorage is attached are rarely if ever moved **bodily** in a mesial or distal direction, and, if **too much force** is applied, there is always danger of inclining the teeth by a slight bending or yielding in the rigidity of the appliance or its cement attachments.

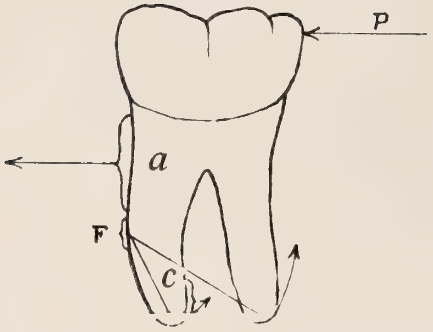
If one will study from a mechanical standpoint the anatomical shapes of the first and second molar teeth — their position, inclination, and length of roots in relation to their natural imbedment in the alveoli — and intelligently note the direction of movement which each root will take in its socket during the process of inclining the tooth mesially; moreover, if he will note the resistance which the three upper roots and the two broad lower roots offer to a direct mesial bodily movement, and will then turn his attention to the crowns, their smooth rounded contours, the narrowness of the coronal zones as compared to the lengths of the teeth to which we are permitted to attach bands — then and not until then can he appreciate the difficulties of preventing inclination and of producing bodily movements of molars with the meagre opportunities presented in the construction and application of regulating appliances.

By "too much force" is meant more force than the possibilities of physiologic movement of the tooth or teeth to be moved requires. This surplus force, be it little or great, added to the already adequate force reacting upon the anchorage may be sufficient to overcome its stationary inertia, which otherwise would not have occurred with an exhibition of more consideration and patience. In other words, the active end of the machine becomes the inactive anchorage for every ounce of the surplus force, because its resisting tissues are already strained to their fullest extent, and are now reacting upon the original anchorage tissues that are ready to move as soon as the force of reaction becomes sufficient.

The dissolving and bending processes that are induced in the alveolar process by direct pressure of the roots of teeth are limited in their degree or rapidity of movement. And when we attempt to go beyond their powers with greater force, we are opposed by the same sort of resistance that occurs when we attempt to thrust a heated poker into ice faster than it is possible for the ice to melt and get out of the way of its movement; with the result that this surplus force reacts and often does something that was not intended. It may break the appliance, strip a thread, cause the anchorage attachment to give way and the teeth to incline, and perhaps more frequently than anything else, produce greater inclination than desired, of the teeth we are trying to move.

The same simple law of physics which applies to front teeth under the active stress of movement applies equally to anchorages. When lateral force is applied to the crown of a tooth at some point, with a hinge movement attachment, that tooth becomes a lever, with its natural fulcrum at the apical end, and with its greatest stress upon the alveolar border. If, therefore, we do not exceed the possibilities of movement at the gingival area in proportion to the apical inertia, we may get no movement at the apical end of the tooth in the opposite direction.

Fig. 24.



If power is applied at "P," Fig. 24, or at one point on the crown of a lower molar tooth in a mesial direction, the principal area of the alveolus which is pressed upon will be that of the mesial root; the greatest force being exerted at the mesio-gingival wall "a" and a lessened force in the opposite direction at the disto-apical wall "c." The immovable center of the circle of inclination movement in this instance would, therefore, be at "F," with a combination movement of the entire tooth which would tend to lift the distal root from its socket with a very little resistance other than that of its membranous attachments. The same principle will also apply to a distal movement of these teeth; and because of it, molar teeth, which are unsustained by adjoining teeth, offer little or no more resistance to inclination movement than do teeth with one root.

It would seem that the three roots of the upper molars would enable them to present the greater resistance to inclination movement, but I have found that they tip quite as easily as the lower molars.

Principles of Anchorage Stability

In contemplating the construction of a molar anchorage appliance that will prevent, as far as possible, a movement of the included teeth, the principal object should be to so construct the device that the great tendency to tipping of the crowns will not be permitted. If this is fully accomplished and the tooth or teeth are held in an upright position, the applied force will be equally distributed over the entire mesial or distal surfaces of the alveoli for all the roots, increasing the stability of the anchorage to an incalculable degree. If the appliance is loosely attached to the teeth or permits the slightest hinge movement, as would arise from a removable crib or a single uncemented band that encircles two or more teeth, there would be nothing to prevent this tipping tendency; though such an anchorage might be sufficient for many purposes, if attached to a sufficient number of teeth and the applied power always less than their combined natural inertia. But instances frequently arise in the regulation of teeth where it is eminently desirable to obtain an anchorage of the greatest possible stability. When it is necessary to employ the back teeth as a stationary base for a considerable movement of front teeth, two or three teeth should be included in the grasp of the anchorage appliance.

The addition of a second tooth to the anchorage, united scientifically, will far more than double its stability by the support which the two teeth can be made to give to each other through a proper construction of the appliance; on the same principle that the strength of a T or a double T girder is increased far out of proportion to the difference in the added material, over that of a plain girder.

Fig. 25.

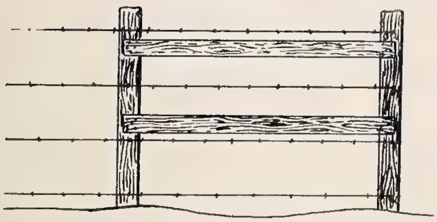


Fig. 26.

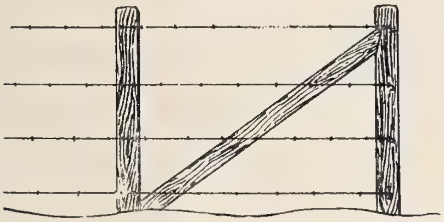
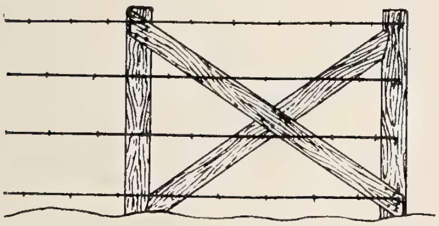


Fig. 27.



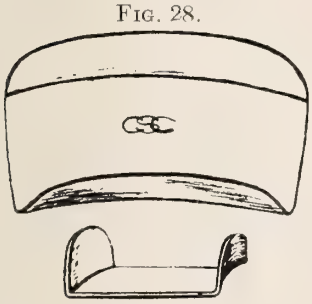
This principle is also well illustrated by the simple mechanical methods adopted in constructing the terminals of wire fences. If the two terminal posts were united by parallel bars which permitted a hinge movement at their attachments as shown in Fig. 25, their movement would depend solely upon the united stability of their imbedment in the ground; but with a single bar placed as shown in Fig. 26 the stability of the terminal is seen to be greatly increased, because inclination movement of the terminal post is obstructed, nearly all the stress of the wires now being exerted at the base of the second post. This device is sufficient for all ordinary purposes of wire fence building. If necessary the terminal stability of the fence could be greatly increased by attaching a second bar as shown in Fig. 27; which would absolutely prevent the slightest inclination movement of either post; and establish an immovability to the extent of a power sufficient to pull their imbedded ends bodily through the ground.

The application of this principle is exactly what we endeavor to apply in the construction of stationary anchorages.

Stationary Anchorages

In the construction of stationary dental anchorages banding material should be selected that is 5 to 6 thousandths of an inch in thickness (Nos. 36 or 35 Gauge) and as wide as the teeth will permit. When these are soldered, festooned, contoured, and fitted to the teeth chosen for anchorages, take a plaster impression of each anchorage separately, using the anchorage trays (Fig. 28) with only sufficient plaster to cover the bands. Carefully remove the bands from the teeth with the band removing pliers, to avoid marring their shapes, and place them accurately in the impression. See that the proximal surfaces are forced closely together and fill with investing plaster, forming small casts of only sufficient size to hold the bands in place during the soldering process. Solder should be flowed between the bands, uniting their approximal surfaces and filling the V-shaped spaces on either side. To more perfectly reinforce the stability of the appliance, fit and solder to the lingual surfaces a piece of No. 16 hook wire in addition to the buccal tube or tubes to be attached for the power bars or traction bows for the movement of the anterior teeth. In attaching

Fig. 28.



the buccal tubes, the advantage of applying the power as near the gingival margin as possible should be remembered. Whenever greater stability is demanded, the power tubes should be placed further root-wise in relation to the gingival margins, as shown in **Ap. 76** and elsewhere.

When such an appliance is fitted and cemented to the teeth it will tend to hold them rigidly in its grasp in an upright position. If the bands are thin and narrow, or the apparatus is not sufficiently reinforced by the solder and otherwise, the slight yielding of the material under great strain will allow the teeth to tip and soon break loose from their attachments.

College Technic Anchorages

For college work, and if desired for any practical case, stationary anchorages may be constructed by uniting the several anchorage bands together with soft solder: providing that the component bands, with all their attachments, have first been hard-soldered.

Construct, or select from the already constructed stock, the first or second molar bands with the proper sizes of tubes or attachments required (**Bs. 75 or 88,** etc.), together with one or two reinforcement bands (**Bs. 71 or 93**), according to your intention of making a two or a three band anchorage. If the teeth are not already separated, the wide separating tape folded and left between the teeth twenty-four hours will usually obtain sufficient spaces. See p. 39, Chapter IV. Contour and festoon the bands and carefully fit them to the teeth for which they were made or intended, and in the position it is intended they shall occupy in the completed appliance.

The reinforcement extensions on **Bands 71 or 93** are cut so as not to interfere with the attachments and are burnished closely to the bands. Leave no overlapping occlusal edges that will interfere with masticating occlusion, and see that the gingival borders completely cover the enamel, and even extend beneath the gum margins around free distal and mesial surfaces of molars.

An **investing plaster** impression is then taken, which sufficiently covers the bands to perfectly mark their positions; after which the bands are carefully removed from the teeth and the proximate surfaces are scraped to facilitate the flowing of the soft solder that is used to unite them. Place the bands accurately in position in the impression, being careful that their proximal surfaces come closely together; then lute the inside surfaces of the bands with a solution of plumbago to prevent the overflowing of surplus solder. Lay the impression with the tray upon a piece of gauze wire or sheet iron over a Bunsen burner. When sufficiently heated moisten the surfaces to be united with muriate of zinc, and feed the soft solder into the joined surfaces between the bands and the reinforcement extensions until they are full. The form of soft solder best adapted for this work is that which is drawn to wire Nos. 14 or 16. When the piece is soldered throw

it into hot water to remove the plaster, etc., and then into a weak hot solution of sulphuric acid, and finish. If the bands have been previously finished and plated polish them with a soft brush.

Sustained Anchorages

Conditions not infrequently arise where it is necessary in correcting a malposition to employ an isolated molar for an anchorage. In protruding cases, where the first molar has been extracted for instance, and the third molar has not erupted, though the main forces may be the occipital and intermaxillary, it nevertheless is necessary to employ the two molars as an anchorage if for no other reason than to support the bow and retain the movement as it is gained. One cannot expect much resistance from a single isolated molar whose inclination movement is not inhibited; and even where it is wholly prevented, much anchorage force will always tend to partially extrude or lift it from its socket. If properly sustained, however, it will answer the purposes of a moderate degree of force, perhaps sufficient to move the bicuspids back, one at a time, with elastics; and also to sustain and retain the movement of a retruding bow which is acting on the front teeth propelled by other forces.

In the construction of the appliance the same rules should be fully observed that apply to sustaining the stability of all anchorage teeth, i. e., (1) The bands should be wide and thick so as to possess a firm grasp of the crown. (2) The engaging tubes should be placed at the gingival margins or more root-wise, and soldered to the band with a long-bearing attachment. (3) The tubes should be of sufficient length, strength, and size to carry rigid inflexible bars or bows for communicating the force, and thus prevent, as far as possible, the slightest inclination movement of the anchor.

A principle which the author presented at the meeting of the American Dental Association in 1897, for sustaining a single molar anchorage is as follows:

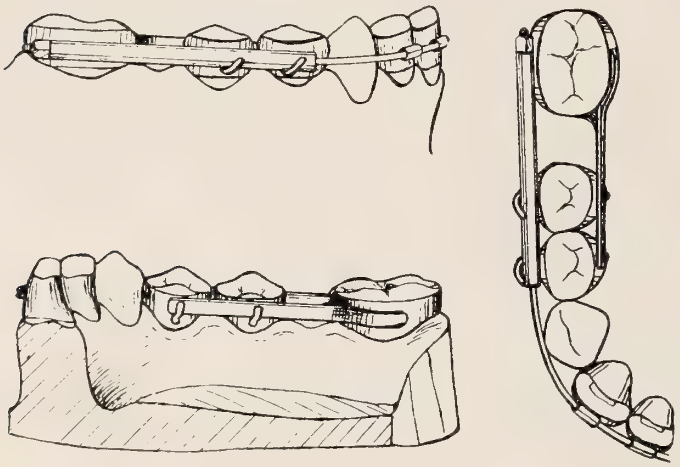
"Instances frequently arise where only one tooth can be used for an anchorage on one or both sides of the mouth. These teeth not being supported by the adjoining teeth will readily tip if not properly sustained. In fact, a molar tooth that is allowed to tip will offer but little more resistance to force than a bicuspid, but if sustained in an upright position it will be impossible to force it bodily through the process with any ordinary power. This is especially true of the lower molars, which, when tipped to an anterior or posterior inclination, are readily forced from their imbedment or partially lifted out of their sockets; but if held in an upright position the two broad roots will resist immovably a much greater amount of force. When a single isolated molar is used for an anchorage attachment the band should be wide and thick, fitted and cemented as carefully as a crown, with rigid attachments for inflexible extensions. However perfect the band and its attachments, if a flexible traction wire is used to transfer the power no obstruc-

tion is offered to the tipping tendency of the molar. The same is true with an inflexible power rod if the band is thin, narrow, and yielding, or in any way movable upon the tooth, or if the power tube is short and loosely fitted to the rod."

Where great immobility of a single anchorage tooth is required, use for banding material German silver or platinized gold, No. 34 gauge, and as wide as the tooth will permit. When this is contoured and fitted solder the power tube at the gingival margin. This should be sufficiently long to permit reinforcing its attachment to the molar with solder to the full width of the tooth.

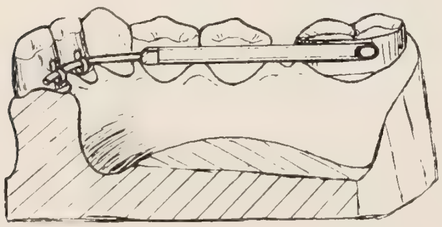
If the power tube is extended forward to the first bicuspid and its mesial end allowed to rest upon narrow projecting hooks soldered to the bicuspid bands, as shown in Fig. 29, it will add greatly to the stability of the anchorage. It will be seen that any tendency of the molar to tip forward, will carry the mesial end of the tube almost directly towards the roots of the bicuspids, the movement being prevented by the rests. Nor will such a device offer any special obstruction to the distal movement of the bicuspids — the rests sliding along the tube.

Fig. 29.



It is often more convenient to sustain the anchorage with a flattened bar soldered to the lingual aspect of the molar band which extends to and engages with lingual rests upon the bicuspids. (Fig. 29). This is especially applicable where it is desired to reduce a protrusion with a small flexible traction bow encircling the teeth, or even in combination with more inflexible buccal devices. Again the lower cuspids may be mesially prominent, the incisors crowded and irregular but not protruded, presenting a condition where the extraction of a bicuspid may be indicated were it not for the fact that the first molar on one or both sides is missing. Here the anchorage for forcing back the cuspid with a buccal bar, may be sustained with a tube instead of a flattened bar, which extends along the lingual aspect of the bicuspids and sustains a lingual bow, which in turn engages with hook attachments upon the incisors as in Fig. 30. If the incisors are retruded the ends of the bow may be threaded for nuts at the mesial ends of the tubes to force the incisors forward, the two forces being reciprocal. It will be seen that any forward tipping of the molars will be prevented by the incisors sustaining the anchorage support.

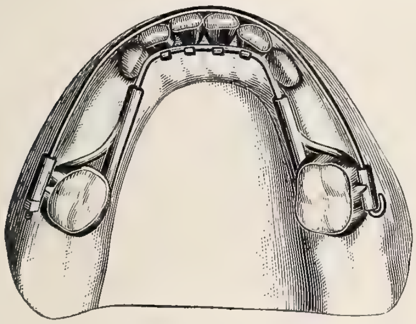
Fig. 30.



A similar device is especially applicable for children who have inherited a

decided protrusion of the lower teeth and where the early extraction of the first bicuspids — before full eruption — is indicated.

Fig. 31.



The lingual supporting tubes should be sufficiently large to allow the ends of the bow to easily glide into them as the incisors are forced back with the labial traction bow, as shown in Fig. 31.

In the preliminary assembling of the apparatus, place the incisor bands (**B. 6½**) first, and then the molar bands (**B. 82**), with the lingual bow in place. See that the bow glides easily in the tubes, so that the retrusion of the incisor teeth with the intermaxillary force and labial traction bow is not obstructed. A practical application of this method of treatment is shown under Fig. 44, Class IV, Chapter XLIV.

Reciprocating or Movable Anchorages

Dental anchorage may be considered as any point of resistance to receive the reaction of the force required for the movement or correction of malposed teeth. Wherever it is possible to do so, these points of resistance should be chosen with a view to utilizing the reaction force for a reciprocal movement of other teeth that require correction. This is one of the most practically scientific laws of orthodontia, though sadly neglected, and one moreover that is applicable in some form in almost every case of irregularity.

In the choice or invention of a regulating apparatus, after the several required movements of the case have been determined, a careful study of the demands, with the reciprocating possibilities in view, will present surprising opportunities for its application. This will be found well exemplified in the details of regulating apparatus presented in this work. Instances arise where it is eminently desirable to move the buccal anchorage teeth mesially or distally to correct occlusion by the same force that is used to protrude or retrude the front teeth. This is accomplished purely by the method in which force is applied, which, through the peculiar construction of the appliances, permits inclination movement. Nowhere is it more applicable than in that common irregularity which is characterized by maleruption of the cuspids, shown in apparatus under Class I of this work.

It will be seen that the reaction of the force to protrude the front teeth in widening the space for the cuspids is received upon bicuspid attachments (See **Bands 65, 66, 67, and 68**) whose peculiar construction is such that the force of reaction is applied at, or near, the occlusal zone, and as near as possible to the line which bisects the central axis, with a tendency to produce inclination without rotation; the whole apparatus being calculated to utilize to the fullest extent the reactive force from the front teeth, in moving the buccal teeth back to normal occlusion while opening the spaces for the alignment of the cuspids.

CHAPTER VIII

PRINCIPLES OF INTERMAXILLARY AND OCCIPITAL FORCE

Intermaxillary Force

One of the most important methods of applying force in the regulation of teeth, and one which is now recognized as an indispensable factor in modern orthodontia, is the **disto-mesial Intermaxillary Force.** This was introduced by the author, February 2, 1893.* It essentially consists in the attachment of elastic rubber bands from the cuspid area of one jaw to the most distal buccal extremity of the molar area of the other, for the purpose of producing a distal or mesial movement of the teeth of one jaw, or a reciprocal distal and mesial movement of both, in correcting a disto-mesial malocclusion of the buccal teeth. See **Ap. 77.** The disto-mesial action of an intermaxillary force which enables its employment for shifting the occlusal relations of the buccal teeth and for all protruding and retruding movements, makes this a distinctive principle in orthodontia, and one that is quite decidedly different from all of the forms of **direct intermaxillary force** that have been used in various ways for many years. Direct intermaxillary force of silk ligatures, to aid the eruption of retarded teeth, was employed in the latter part of the 60's by Dr. Jerry A. Robinson of Jackson, Michigan.

The most practical form of **direct intermaxillary** force is that which was introduced by Dr. E. H. Angle, and published in the Dental Cosmos, September, 1891, which describes the employment of this method for extruding impacted upper cuspids and incisors. The principal use which the author makes of this form of force is in the correction of **Open and Close Bite Malocclusion,** a description of which will be found in Specific Methods of regulating in Classes III and VII.

The rubber bands that are well adapted for the **disto-mesial intermaxillary force** are known to the trade as "election rings" and can be purchased at almost any rubber house. Where greater force is required, two may be employed, or the single ring may be doubled or looped twice upon the hooks.

The action of these small elastic bands exerting a continuous force upon the teeth of youths will at times accomplish results that are surprisingly remarkable. Moreover the ease and facility with which the elastics are àdjusted and worn by

*As the origination of the application of the Intermaxillary Force has been claimed by others, and as it was erroneously named the "Baker Anchorage" by Dr. Angle, nearly ten years after it had been quite extensively published by the author and employed by many prominent dentists, the reader who is interested in the historical part of the subject is referred to the articles entitled "Origin, Use and Misuse of the Intermaxillary Force," published in the Dental Cosmos, May, 1904, and "Rise and Development of Intermaxillary Force," published in the Dental Cosmos, May, 1907.

the little ones uninterruptedly — even during eating — increases the practical applicability of this method in the regulation of teeth.

This method of applying force is particularly useful in all cases of general protrusion and retrusion, and especially in cases of protrusion of the teeth of one jaw and retrusion of those of the other, where the full reciprocating activities of the force can be utilized. When properly applied in this way to the teeth of youths, the correction of malocclusion and facial contours is found to be easily accomplished in numberless instances that would have been considered at one time impossible without extraction. Frequently the teeth are moved by this force alone one-half the width of a cusp, or reciprocally the full width of a bicuspid which is equivalent to the operation of "jumping the bite." See Figs. 34, 35, and 36, Chapter XIV. Moreover, it is an indispensable adjunct to the occipital force in a great variety of conditions, particularly where the buccal teeth — both upper and lower — have drifted forward from local causes. It is also one of the most important adjuncts for the reinforcement of weak molar anchorages, or whenever it is desirable to transfer the force from a weak point of reaction to the teeth of the opposing jaw. It is also indispensable in the treatment of many conditions which heretofore have baffled our possibilities of applying force, among which may be mentioned the abnormal lateral malposition of the lower jaw and teeth, caused (1) by the bending of the lower jaw in babyhood, (2) by malocclusion, (3) by unilateral luxation.

In view of the great possibilities of this principle, which has been so freely given to the profession, it is a most unhappy spectacle to see its true place in Orthodontia so openly misunderstood and misapplied by men, who, it would seem, having recently learned that it is possible to shift the positions of the teeth to a normal occlusion in this way without extraction, go so far as to assert and endeavor to establish the fallacious theory that "when the teeth occlude normally the facial lines must of necessity be perfect — that one condition is incompatible without the other," etc.

In all disto-mesial malrelations these misguided operators apply the intermaxillary force with a view to a reciprocal movement of the upper and lower teeth, primarily for the sole aim of producing "normal occlusion" of the buccal teeth, blindly believing that when that is brought about they have the only true basis for the correction of the front teeth according to the ideal facial outlines; because as they claim: "The facial lines are dependent upon the normal occlusion for their normal relationship. Hence the occlusion is the factor of prime importance rather than the facial lines." * In Chapter XII of this work I have endeavored to point out some of the errors of this teaching, which, to all who calmly view its influence from a broad and true light, must appear in this age as a sad commentary on the progress of dento-facial art.

Though the scope of the intermaxillary force has been greatly overestimated

* Pullen — Items of Interest, July, 1904, page 542.

and misapplied, it nevertheless is a power in Orthodontia that has come to stay and grow in favor, as it has with the author during the fourteen years of an extensive and successful experience in its use.

For the protrusion or retrusion of the teeth of one jaw, as explained in early papers, the force of the reaction should be distributed through the medium of the apparatus to the teeth of the opposing jaw so as to avoid movement. If a retrusion of the teeth of one jaw be required, with no mesial movement of the opposing buccal teeth, the hooks for the attachment of the elastics to the opposing jaw should be placed at the disto-buccal extremity of stationary anchorages and near to the occlusal zone, in order that the line of force shall be as nearly parallel as possible to the occlusal plane, to reduce the extruding tendency of the force when the jaws are opened. Its extruding action is one of the main objections to this principle of applying force, and certainly one that must limit its application. Especially is this true when the rubber bands are attached to single molar anchorages, particularly the first molars, as has been advocated.

It should always be borne in mind, as elsewhere stated, that the distal movement of buccal teeth requires far more force than their mesial movement, because the distal bases of the respective arches, at whatever age the operation is undertaken, will be found to rest against a solid foundation of alveolar process and true bone, or against erupting teeth which are forcibly crowding their way into the arch between firmly resisting masses. This is especially true of the lower arch whose bases are composed of broad and solid ridges of bone supported by the ascending rami.

In both directions of movement the apical ends of the roots are rarely if ever moved with the application of intermaxillary force — the movement being purely that of inclination. In Chapters XI and XII are pointed out some of the objections and dangers in a considerable distal movement of the molars..

In the contemplation of employing the intermaxillary force for the correction of malocclusal and dento-facial relations it should be remembered that the ungoverned action of the elastics will in all probability produce a far greater mesial movement of one denture than a distal movement of the other. While this may perfectly correct the occlusion, the dento-facial outline may be left in quite a protruded state, because the case may have been one which required a greater distal movement of one denture than a mesial movement of the other. And this would hold true also, though to a less extent, in cases where an equally reciprocal movement of both dentures is demanded. On the other hand, in cases where the mesial movement should be greater, as in slight protrusions of the upper in connection with a considerable retrusion of the lower, as described in Class III, the unrestricted action of the intermaxillary elastic may perfectly perform the disto-mesial correction demanded, and without recourse to the extraction of teeth.

In addition to restricting or preventing the movement of one denture by anchoring the teeth together in phalanx, there are a variety of effective methods

for accelerating the movement of the other denture; or rather, of producing the greatest possible movement with the least exhibition of force. This is accomplished principally in two ways:—First, by applying the force through the medium of movable attachments at the occlusal zone with its advantage toward inclination movement; and, second, by applying the force, first, to the most distantly located teeth in line with its action, and then to the next teeth in line, etc., until all have been moved. The various methods and technic principles will be found fully described and illustrated in detail in the respective classes of irregularities where the intermaxillary force is applicable.

Occipital Force

The principal force with which the Intermaxillary is an important auxiliary is the Occipital, and as these two forces, in the author's practice, have become so largely dependent upon each other, working together and in conjunction with dental anchorage forces, he deems it advisable for all who essay the regulation of teeth to thoroughly acquaint themselves with the principles and latest methods of its application.

A description of the latest **Occipital Apparatus** and its action will be found under **Ap. 78 to 81** inclusive, and in classes of irregularity where this means of force is applicable.

The **Occipital Force** was among the first to be used for the regulation of teeth—the early practitioners recognizing the advantage of locating the base of anchorage completely outside of the immediate field of action. This same need or "necessity was the mother of the invention" of the **intermaxillary force.** As means develop for applying these forces in a scientific and skillful manner, they will be considered more and more among the indispensable powers for the regulation of teeth. This can only be accomplished by a full appreciation of dento-facial relations, and the adoption of applicable variations in methods and apparatus which will make the proper corrective movements possible.

One of the greatest objections and drawbacks to the more general adoption of the **occipital force** has been the discomfort and irritation, if not actual pain, which the various forms of headgear apparatus that are sold in the market give to sensitive patients; and which so frequently causes them to omit wearing it a sufficient portion of the time to be of real service.

An **occipital apparatus** should be one that can be perfectly fitted by the operator to the form and requirements of the individual patient, with no prominent or projecting portions to interfere with the pillow while at rest, and one which can be easily adjusted by the patient and worn with the least possible discomfort during sleeping and waking hours. The principal direction of its movement is upward and backward, with a tendency toward the production of

a movement when applied to the teeth that is frequently demanded and **which can be accomplished in no other way.**

One of the cases for which this direction of force is particularly applicable is in upper protrusions, where the labial teeth are in a decidedly extruded position in relation to the upper lip, and in connection with which the lower incisors often strike the gum back of the upper incisors. See Close Bite Malocclusions. **Ap. 85.** The post rest **bow A, Ap. 78,** is especially adapted for this movement.

Another irregularity for which this direction of force is especially applicable is in **protrusions of the lower teeth with an open bite malocclusion,** for which the lower **bow B** will be often found effective. See **Ap. 89.** The possibility which is now presented for applying the occipital force directly to the lower labial teeth in phalanx, through the medium of a lower occipital bow, as an aid to the correction of open bite malocclusions where the lower jaw and teeth are protruded, would render the occipital force indispensable in the author's practice even if it could not accomplish another object. See Bow B. **Ap. 80.**

One of the most modern and valuable possibilities of the occipital apparatus is that which now enables the application of this force directly to the **buccal teeth** through the medium of the **bow C.** See Fig. 4, **Ap. 70.** In this connection it is especially valuable as an auxiliary to the intermaxillary force. By this means, as is fully explained, the two retruding forces can act upon the most distal upper molars, or all of the buccal teeth, without exerting any force, if not desired, upon the labial teeth. In fact, as shown by **Ap. 70** in Class I, the incisor teeth can be protruded from the molar anchorages while the bicuspids and molars are retruded with the occipital and intermaxillary forces, to open spaces for the eruption of crowded cuspids.

Again the occipital and intermaxillary retruding forces can be applied to an upper molar upon one side and a cuspid, or all of the buccal teeth upon the other, or upon any one of the buccal teeth upon one side alone.

It will be seen that the entire apparatus is so constructed in its several parts that it may be easily adjusted by the operator to any desired size and form and thus perfectly fitted to each individual case. If proper care is exercised in this regard, with the usual co-operation, no patient will object to wearing it. Many patients older than 20 years, in the author's practice, are wearing the apparatus without the slightest complaint. Younger patients of course will always adjust themselves to anything that is reasonable.

The application of occipital force to the chin for the bodily retrusion of the lower jaw, which has been in the past quite a popular practice, is now rarely considered of practical advantage after the years of childhood. If the apparatus can be made comfortable for the little ones, so they will voluntarily wear it with sufficient persistence, no doubt much can be accomplished in this way. The chin-cap shown in **Ap. 81** will appeal to all who desire to apply this method of force.

CHAPTER IX

PRELIMINARY PRINCIPLES OF PRACTICE

Fitting and Assembling the Apparatus

In the contemplation of assembling and placing a finished regulating apparatus, the several bands should first be accurately refitted to the teeth, in order to see that they go fully and readily to place, so that the rapid movements required by the setting cement in the final placing are not obstructed.

The preliminary placing of the bands will show if the teeth are sufficiently separated; the bands, of the right size and properly trimmed, contoured and finished; the attachments accurately located, etc. At this time the motive parts, such as jacks, traction bars, pull and push lingual bows, etc., should be perfectly fitted and temporarily assembled in order that the advisability of connecting them with the bands at the time of cementing may be considered. With nearly every apparatus there is an "easiest way" of assembling certain of its parts, and frequently this is the only way they can be brought together on the teeth. In the text description of the different apparatus, specific directions, where essential, will be found relative to this important feature.

Placing the Apparatus

Unless the apparatus is a very simple one it is rarely advisable to cement and place the whole of it at the first sitting. It is usually best to cement the molar bands first. If these are stationary anchorage appliances, composed of two or three bands that require driving to position, as they commonly do, they may be allowed to remain upon the teeth for twenty-four hours without cementing, to produce the movements necessary for easy and quick placing later.

At the time of cementing the bands, the teeth should be thoroughly cleaned, and then dried with spunk or cottonoid; pack enough around them to prevent secretions from coming in contact with the work until it is completed. The final drying of the teeth may be done with warm compressed air.

The bands should also be dry and their inner surfaces perfectly clean. With bands whose possibilities of attachment are light, as for partially erupted cuspids, etc., the inner surfaces should be roughened with a sharp pointed instrument. Some cements should be kept as dry as possible until they are perfectly hard. A cement which sets slowly and one that will not become weakened by contact with moisture soon after the band is in position is preferable.

The complaints raised in regard to regulating bands coming off is due far more to manipulation than to the quality of the cement. The bands may not accurately fit the teeth; or they are not thoroughly driven on; the cement may be mixed too thick, or the movements are not sufficiently rapid to fully place the band, before the cement commences to set. Thoroughly mix the cement to about the consistency of cream, and quickly place it within the band along its entire gingival border, forming a continuous rope about the size of white twine. The aid of an intelligent and skillful assistant is invaluable in this operation — one who knows when and how to mix and place the cement rapidly; who hands the bands the right side up and in relative position; assists in holding back the tissues; is ready with the instruments required; and finally, is an intelligent and skillful malleter. See page 45, for use of wood plugger and heavy mallet.

Immediately after the bands are fully in place and before the cement is hard, quickly burnish the gingival and occlusal borders to fit the teeth, especially at interproximate surfaces. The motive parts which do not require to be assembled with the bands are usually placed at a later sitting; it frequently becomes necessary for this purpose to cover the free projecting band attachments with gutta-percha. This permits the patient to become gradually used to the apparatus, and the cement to become thoroughly hard before any force is put upon the bands that otherwise might dislodge them. In placing the motive parts, the open tube and hook rests should be perfectly closed around the bars and bows and all sharp or projecting irritating edges removed.

Application of Force

In commencing the application of the several forces it should be gradual, so as to minimize the severe irritation and pain of its first application. If the means for applying the force are such that the application is uninterrupted by repeated complete cessations (as is necessary in the use of wire ligatures, etc.), patients soon become accustomed to the necessities of the operation, and rarely complain of any pain or annoyance after the first two weeks, and only at the times when it is necessary to change the order and direction of force, or the appliance. Because of this fact, dentists who are unaccustomed to the often painless action of positive and intermittent forces of a screw, will apply too much force, and too often, under the belief that it is proper to make the appliances and force methods do all that the patient is willing to stand, and sometimes a good deal more. They seem to think it quite a feather in their caps to be able to say at conventions and elsewhere that they moved a tooth or teeth an unusual distance with such and such an appliance in a few days or weeks. There never was a more mistaken cause for pride. It would be far more to their credit to say, "I took plenty of time and gave little or no pain or disturbance to the patient or devitalizing influences to the teeth; and, by moving them slowly, secured less resistance to the

retention." There are important mechanical reasons also why force should be applied in a moderate degree. See Chapters VIII and IX.

Important Properties.— Besides its force capabilities, an apparatus for the regulation of teeth should possess certain important qualifications, i. e., It should be one that is as inconspicuous as possible; and that can be worn with ease and comfort by the patient without endangering the health of the teeth or surrounding tissues, so that none of the duties of life are interfered with and its general disturbance to the system reduced to a minimum. This is especially important with young and developing girls, whose nervous systems are under the natural strains of budding womanhood, often enhanced by the anxieties of school work.

Physiologic Movements of Teeth.— The time required for the interstitial resorption on the one hand and growth of alveolar tissues on the other, in the process of moving teeth, will vary with different patients. Nor is it always in accord with the age. Again, teeth do not move wholly by virtue of these processes, but to a large extent by the bending of the fibrous cancellous structure of the alveolar process; and occasionally, when a phalanx of three or more teeth are involved in a labial or buccal movement, the entire alveolar arch itself is carried with them.

If the movement could be gauged exactly in proportion to the possibilities of nature to restore by the growth of new tissue, or to bring to equilibrium by interstitial molecular changes the fibrous structures that are bent and stretched, retention would be assured, providing that the forces of occlusion, muscular action, etc., did not oppose. Though such slow movement is not always advisable, it stands to reason nevertheless that with rapid movements there is far greater interstitial opposition to retention, to say nothing of the danger to the vitality of the teeth and general disturbances.

Screw Force

The positive and intermittent forces of a screw will probably always remain the ideal force for the regulation of teeth, as it comes nearer to the physiological requirements of nature. Dr. Farrar in his very admirable work entitled, "Irregularities of the Teeth" has gone into this phase of the subject from a scientific standpoint, which is well worth the perusal of every student of Orthopedic Dentistry. He says in part: "That while apparatus which will exert force continuously, if properly made and judiciously applied, will under favorable circumstances move teeth in accordance with the physiological functions of the tissues, apparatus constructed with the view of acting intermittently at will is more scientific because always capable of exactness of control, holding the ground gained, and also permitting the patient, as well as the operator, to take advantage of the benefit derived from the law of labor and rest."

In the author's practice in nearly all cases when this character of force is

used, it is not necessary to see patients oftener than three times a week, and at these sittings the nuts are rarely given more than one full turn and usually three quarter turns — each quarter being made by a single movement or grasp of the wrench. In turning a nut the shaft of the wrench should be slightly rotated in the grasp of thumb and fingers, in addition to swinging it through the required arc.

Misapplication of Force. — The application of continuous forces cannot be as perfectly gauged or controlled as those of a more positive and limited action, therefore they more frequently do harm, either from the application of excessive force or because the movement is not watched and controlled, or the attachments are inadequate. As for instance, when a resilient rotating bar is attached without the controlling adjunct of an alignment bow, etc., again where elastic and other ligatures are permitted to force their way beneath the gum and injure — often fatally — the pericemental membrane. I believe that the greatest harm along this line will arise from the unskillful and inconsiderate use of wire ligatures, which have of late become so popular. This will come from both the too frequent application of excessive force, and the lack or inadequacy of controlling attachments, it being unfortunately recommended that they be used at times even without bands. In many cases, moreover, even when their positions are controlled by perfect band attachments, the crowded relations of the teeth necessitate the passage of the wire through the interproximate spaces often far beneath the gingivæ.

The space which these wires require between the teeth must always limit their use in the hands of careful dentists, who are unwilling to run the risk of attaching them at the necks, with the possible danger of mutilating the pericemental membrane. I believe that the seeds of incalculable harm to the teeth are being sown by the thoughtless and extensive use of these brass ligatures — and for that matter, other unscientific applications of force — which should receive a just protest from the dental profession. I do not wish to be understood as claiming that they have not a valuable place among the many other means of applying force for the movement of teeth; for they certainly have, in those instances where they are applicable and are used intelligently. Dr. Angle deserves great credit for their introduction and I have no doubt will voice me in this warning note against their indiscriminate and inconsiderate use.

Elastic Force

The continuous forces that may be exerted by elastic rubber bands and ligatures and the resiliency of spring bows and bars are invaluable in the regulation of teeth, because they can frequently be applied where it is impossible and inadvisable to use the screw. This character of force is especially valuable in its intermaxillary application; in the movement of recently erupted teeth; in the rotation of teeth; and in all cases where it is impracticable to see the patient

often, providing always that the apparatus is so constructed that it is impossible for it to do harm by uncontrolled action.

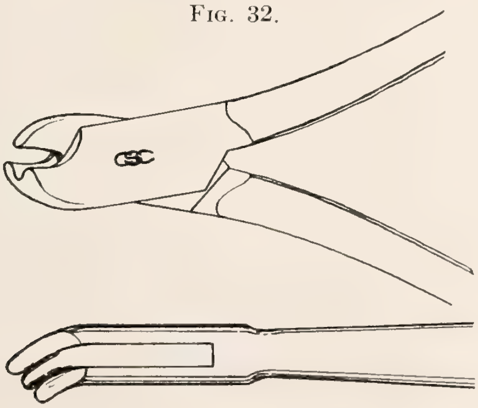
Silk Ligatures

As the case progresses, unexpected and undesired movements will arise that require frequent attention and thoughtful management to control. One of the most important adjuncts for the control of the forces of an apparatus, especially in simple or complex malpositions, and for the prevention of movements of every character that are constantly arising in the operation, is the judicious and skillful use of very fine silk ligatures — Corticelli A preferably, and occasionally Corticelli Twist D. I have often said that were I deprived of this aid I would quit the practice. No apparatus, however well adapted and constructed, and especially those which exert a variety of forces upon the front teeth, will always produce exactly the movements required without the frequent aid of controlling influences, which often tax the skill of the operator. This may be due to unequal rapidity, or direction of movement that was not anticipated, and that demands a change of the appliance or direction of its propelling force; but more often it is one that can be easily controlled by the tiniest of silk ligatures. The force which these small resilient threads — hardly larger than a hair — will exert at times is simply remarkable. See **Ap. 35**, etc., and text. The resilient extensibility of the finer qualities of silk thread, which is about 1 inch in 24, is an important factor in its favor. Also, on account of its smallness, the waxed ligature can remain for days about the teeth without becoming foul.

Bending of Bars and Bows

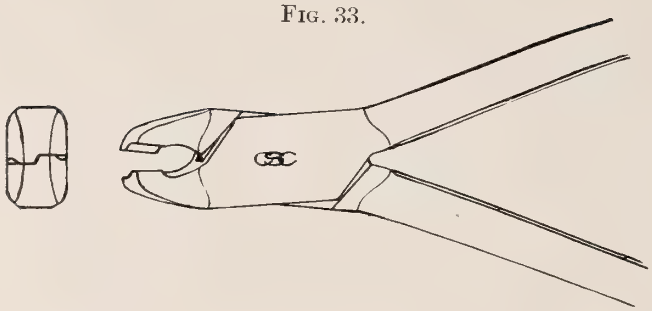
It may be that a wire bar or bow is causing certain teeth to which it is engaged to intrude, extrude, or rotate on account of a slight misplacement of the

Fig. 32.



band attachments in relation to the line of force, and that frequently requires the wire to be bent to relieve the unequal tension. This is commonly a painful and

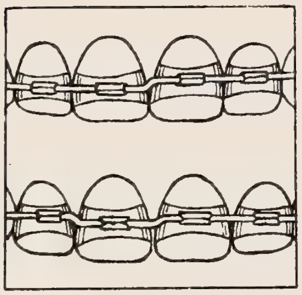
Fig. 33.



difficult expedient with a free hand movement and with pliers that are not especially constructed for the purpose. For the bending of the larger wires, the right and left **Wire Bending Pliers** shown in Fig. 32 will be found invaluable.

Alignment bows which engage with hook and open tube attachments of front teeth will more frequently require bending, to lower or raise the line of force. For this purpose the right and left **Step Pliers,** shown in Fig. 33, are especially useful, being so constructed that a short step bend can be made in the bow between the band attachments, with little or no pain to the patients. A step bend can be made on both sides of the attachment and thus exert a special intruding or extruding force, as shown in Fig. 34. It should be remembered that the step bend of a wire shortens its length, and that this particular action is exactly opposite to Dr. Angle's pliers for lengthening wires. It therefore may be used to exert a pull force in small wires that are attached between two points of action.

Fig. 34.



Removal of Bands

Bands whose attachments are found to be inadequate or are so imperfectly placed as to render the control of movement impossible should be at once removed and replaced in a more perfect position, or changed for others that are properly constructed.

The removal of single bands and especially the removal of stationary anchorage appliances that are perfectly fitted and cemented, has always been a difficult, painful, and often an impossible operation without slitting the band. This can now be readily accomplished with the **Band Removing Pliers,** which enable the operator to safely use the occluding or incisal surface of the tooth as a fulcrum for one jaw of the pliers while the band is completely lifted from its attachment with the other. The two forces being reciprocal, little or no force is exerted upon the alveolus. In the preliminary fitting of bands these pliers are also invaluable. See Fig. 59, p. 46.

When it is not desirable to preserve the bands and also when the attachment is unusually firm and the teeth exceedingly sensitive, they can always be easily removed by cutting them with the **Band Slitters.** See Fig. 60, p. 46.

Alignment Bows

A great many seem to be unable to understand the function and usefulness of a **resilient arch alignment bow** as small as No. 22 or 23. It is one of the most useful and necessary appliances in the regulation of teeth. Again, like "Aesop's tongue," it is one of the most injurious and misleading if its object is not fully understood and controlled. Its objects are: First, to bring malposed teeth into alignment by its resilient force *from adjoining teeth* (See **Aps. 1, 2, 3, and 4**); Second, to preserve the symmetry of the arch while other forces are at work on malposed teeth that would otherwise force them or adjoining teeth out of alignment (See Groups II and III); Third, as a retruding bow for front teeth from stationary anchorages.

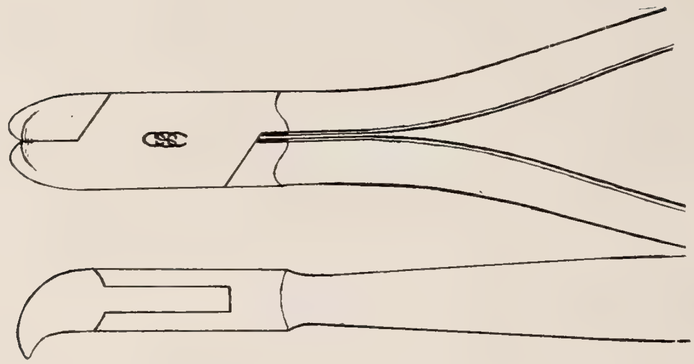
A wire even as small as No. 22, if properly drawn for thread strength and perfectly threaded at one end for carrying an equally perfect threaded nut, is one of the most efficient and inconspicuous forces for retruding the front teeth that we have, especially when assisted with the appropriate auxiliaries. See **Ap. 76**, etc.

When a small wire **arch bow** is used purely for purposes of alignment, the nut at one end is for the purpose of taking up or giving slack. If kept too tight, the teeth cannot assume perfect alignment in the restrained arch and even though one succeeds in forcing the desired tooth or teeth into place, other teeth being pressed upon will be found to intrude, extrude, or rotate, in order to find room in the restricted space. Another error is to cause the wire to act as an expander in placing it without the necessary precaution of first drawing it over the ball of the thumb until its ends almost meet. It would hardly seem that so slight a force would produce this result, and yet when sprung into single molar anchorages for young patients, these teeth will soon assume a buccal inclination. This movement, however, is partly due to the traction force of the bow at the peripheral surface of the arch, and will frequently occur even with arch bows as large as No. 16, where much traction force is exerted with distal nuts at molar anchorages, unless the movement is otherwise controlled as described in Group IV.

Assembling Alignment and Traction Arch Bows

Before placing small alignment or traction arch bows in position, see that the extreme threaded end, or ends, are conical, and that the nuts start to their seating easily. Cut the unthreaded end off so that it will project through its anchorage tube one-half inch, and anneal this portion to be bent sharply forward upon the tube after the nut has been seated. Never fail to give the wire the proper arch curve as mentioned above. Place the threaded end in its anchorage tube with a sufficient portion projecting to seat the nut. Then carry the unthreaded end to its place. If you find that the end projects too far through the tube cut it off the proper length while in place. **Cutting Pliers** shown in Fig. 35 are especially

Fig. 35.

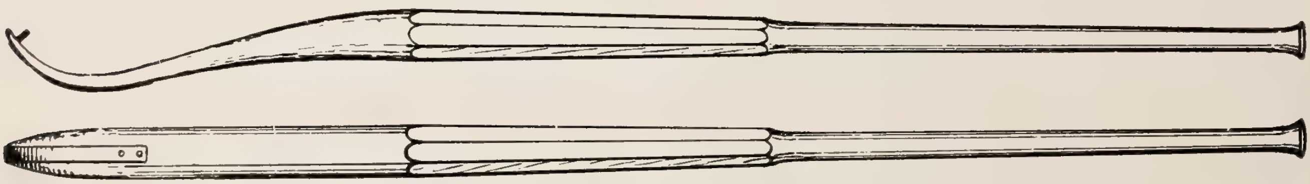


designed for cutting wires at the distal ends of molar anchorages. They have long handles and short curved beaks, which are shaped to protect the buccal mucous membrane.

Placing Distally Located Nuts

In seating the nut, grasp it with gold carriers so that it can be placed squarely over the conical projecting end of the screw, and lightly hold it in place with the end of the finger or nail while you let go with the carriers and use them to turn the nut by pressing or cuffing against one of its sides or corners until you feel that the thread has caught; after which you can give it a few turns with the wrench. A little practice will render this operation a surprisingly easy one to those who have previously had trouble in seating a nut at the distal end of a molar

Fig. 36.



anchorage. Under especially difficult conditions, and with many, under all conditions, the **nut seater** will be found a valuable aid. Fig. 36. With this the nut can be carried to place and held with one hand while the other starts it upon the thread. The pin which supports the nut is fastened to a back-spring which permits the threaded end of the wire entering the nut. When sure that the nut has caught the thread, the **unthreaded end** of the bow may be grasped with long, narrow, flat-beak pliers, close to the distal end of the tube and bent forward sharply to lie along the gingival border of the tube. If it is sufficiently long, the extreme end may be bent at a right angle and tucked behind the bow at the mesial end of the tube.

If one will always take the above precautions in placing an alignment or traction arch bow, the operation will be found one that is rarely difficult.

Expansion and Contraction Arch Bows

All arch bows heavier than No. 20 should be bent to conform to the shape of the normal arch before placing. As the strain upon nearly all arch bows which are employed for retruding or protruding the labial teeth from molar anchorages tend towards exerting an expanding force at the molar area, the Nos. 19 and 18 should be more or less contracted at the ends. The rigidity of the heavier bows, such as Nos. 16, 14, and 13, will usually be sufficient to prevent a change of form.

The principle which is emphasized by Dr. Angle in the introduction of the arch bow, which he terms the "expansion arch" (or any No. 16 bow properly bent), is of the greatest importance in the regulation of teeth, and one which should be taken advantage of in those instances when it seems necessary to use bows of large heft. The system, however, which depends upon wiring unbanded teeth to No. 16 arch bows, now so popular with many, is to be deprecated, as the same results may be attained with more delicately constructed bows that are less conspicuous and which with auxiliaries afford means for the regulation of teeth that are less painful and less liable to do harm.

Hygienic Requirements

Perfect cleanliness of the teeth is of the utmost importance during the wearing of regulating appliances, because of the increased opportunities for the lodgment of food and decaying detritus. There is no reason why, with a perfectly fitted apparatus properly cared for, that the gums and teeth should not remain perfectly healthy during the entire process of regulation. Patients should be supplied with the proper brushes, powders, washes, etc., and instructed in regard to their use. One of the most important adjuncts in this line is a bulb syringe for ejecting a small forcible stream of warm water, prepared with any good antiseptic wash, between the teeth and around projecting attachments. Any appearance of neglect on the part of the patient to attend to these duties should receive immediate attention and admonishment. If it is found that the interproximate gingivæ become inflamed and hypertrophic, it will be usually due to imperfectly fitted interproximate extensions of the bands. If this action cannot be controlled by burnishing the bands more closely to the teeth, and with the application of a solution of Tannic Acid and Iodine, the said bands should be removed, the extended points of gingivæ snipped off, and the bands more deeply festooned so as not to extend so far beneath the borders of the gum. I occasionally remove an entire apparatus, and leave it off for several days, and even weeks, for the sole purpose of giving the teeth and the patient a rest and nature a chance to restore the affected parts to healthfulness. There is no objection to this procedure, nor will it, on the whole, materially retard the operation, as the teeth can be quickly brought back to their positions of movement.

The difference in the hygienic effect of the different mouth washes is small in comparison to their hydraulic advantages when forcibly ejected. However, I have found Dr. Charles Pruyn's Mouth Wash, which he presented at the Illinois State Meeting in 1902, especially adapted for regulating cases, during the early stages of treatment where its obtruding influence is valuable. It is as follows:

Acidi Borici	ʒ iij
Phenol	
Olei Cassiæ	
Chloroform	āā ʒ i
Olei Menthæ Piperitæ	Gtts X
Alcohol	℥ iijss
Glycerinæ	adqs ℥ viij
M. Sig.	

Half a teaspoonful in half a glass of tepid water.

The small amount of chloroform and carbolic acid it contains causes it to act as a local anesthetic. If a teaspoonful is poured into half a glass of water as warm as it can be comfortably held in the mouth, and used in this way, it will be found to give great relief to the pain of attaching or changing an appliance. For later general use in the syringe it need not be so strong, and should be prepared preferably without the chloroform ingredient.

PART III

Primary Principles of Diagnosis and Treatment

CHAPTER X

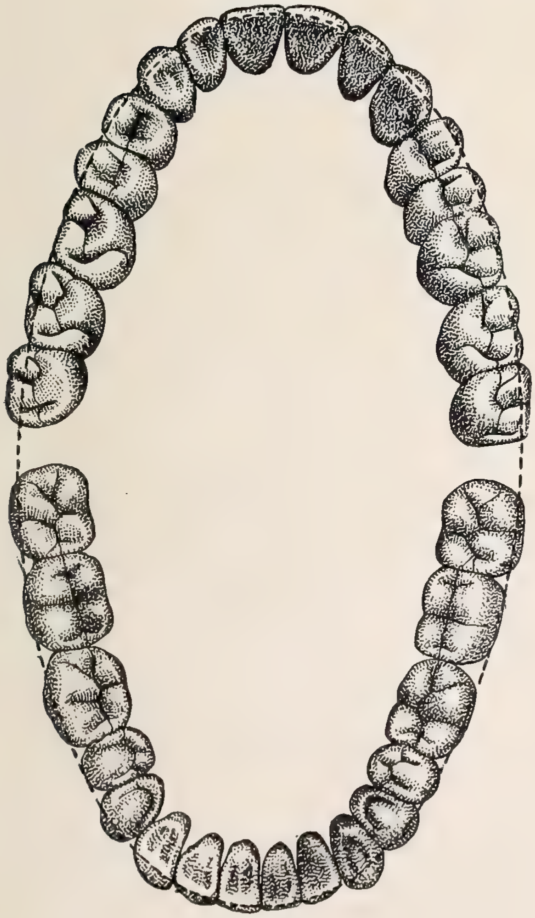
ARRANGEMENT OF THE TEETH AND ALVEOLAR PROCESS ANATOMICALLY CONSIDERED

The foundation of all training calculated to fit one to enter the practical field of Orthopedic Dentistry must lie in a perfect knowledge of Nature's **anatomical arrangement** and **occlusion of the teeth,** and the form and structure of the **alveolar process.**

This is most perfectly described in the incomparable work "Dental Anatomy," by Dr. G. V. Black, who has kindly permitted the republication of it in this chapter.

ARRANGEMENT OF THE TEETH

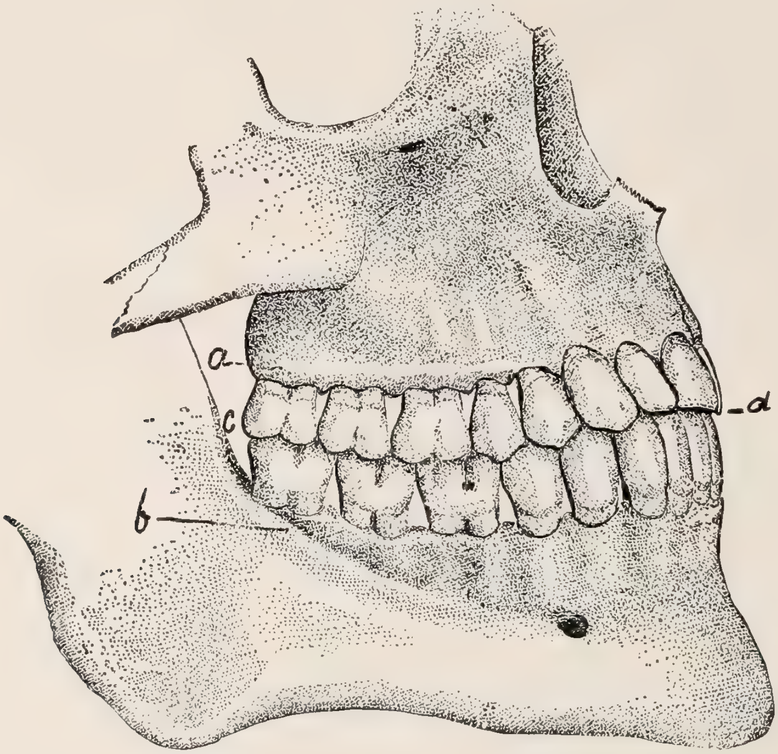
Fig. 1.



"The **upper teeth** are arranged in the form of a **semi-ellipse,** the long axis passing between the central incisors. In this curve, the cuspids stand a little prominent, giving a fullness to the corners of the mouth. In different persons there is much variation in the form of the arch within the limits of the normal. Occasionally the bicuspids and molars form a straight line, instead of a curve, and frequently the third molars are a little outside the line of the ellipse. In the examination of casts of the most perfect dentures, it is found that the two sides do not perfectly correspond, and that certain teeth deviate slightly from the perfect line. The incisors are arranged with their cutting edges forming a continuous curved line from cuspid to cuspid, and this line is continued over the cusps of the cuspids and the buccal cusps of the bicuspids and molars to the distal surface of the third molars. From the first bicuspid to the third molar the lingual cusps of these teeth form a second line of elevations. Between these two, the lingual and buccal cusps, there is a continuous but irregular valley, or sulcus.

"The **lower teeth** are arranged similarly but on a slightly smaller curve, so that the line of the ellipse, which falls on the buccal cusps of the upper bicuspids and molars, will fall upon the buccal surfaces near the gum on the lower teeth (Fig. 1). Therefore in occlusion the upper teeth project a little to the labial and buccal of the lower at all points of the arch (Fig. 2). The incisors and cuspids

Fig. 2.



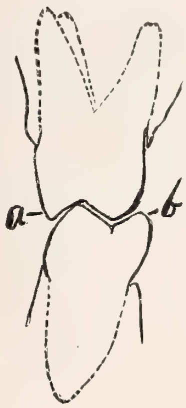
occlude so that the cutting edges of the lower incisors and cusps of the cuspids make contact with the lingual surfaces of the similar teeth of the upper jaw near their cutting edges (Fig. 3). In this, however, there is much variety within the limits of a **normal occlusion.** Sometimes the lower incisors strike the lingual surfaces of the upper near the linguo-gingival ridge, and may strike at any point between that and the cutting edges. In **abnormal occlusions** the lower incisors may miss the upper, striking the gums posterior to them, or they may occlude anterior to the upper incisors. The broad cusped occluding surfaces of the bicuspids and molars of the opposing dentures rest on each other in such a way that the lingual cusps of the upper teeth fit with more or less accuracy into the general sulcus formed between the buccal and lingual cusps of the lower teeth. The buccal row of cusps of the lower teeth, in a similar way, are fitted into the sulcus formed between the buccal and lingual cusps of the upper teeth (Figs. 4 and 5). This arrangement is such that when the teeth are in occlusion it leaves the buccal inclines of the buccal cusps of the upper teeth outside the buccal surfaces of the upper teeth (a). And, also, leaves a ledge formed by the abrupt lingual inclines of the lingual cusps of the lower teeth along the lingual line of the

occlusion (b). This brings the occluding surfaces of the teeth in the best form of apposition for the purpose of mastication. The forms presented to the cheek and to the tongue hold these soft tissues a little apart from the actual contact points of the occlusion, and thus prevent them from being caught and pinched, or crushed, between the teeth in the act of mastication. In youth, while the permanent teeth are taking their places, and before the cusps are properly fitted to the sulci, we often find the cheeks or tongue wounded by being caught between false occluding points. With the after movements of the teeth, by which they are more perfectly arranged, this difficulty disappears.

Fig. 3.

Fig. 4.

Fig. 5.



"The **line** from before backward on which the occlusion occurs is not quite a plane; in the lower jaw it presents a slight curve, or concavity, and in the upper jaw a convexity (Fig. 2, c to d). The concavity of the line of the occluding surfaces of the lower teeth is a little greater than the convexity of the upper, so that the cutting edges of the lower incisors pass a little beyond, and to the lingual of the cutting edges of the upper incisors.

"In the **occlusion,** the relative mesio-distal position of the particular teeth of the upper jaw to the lower is important (Fig. 2). At their cutting edges the upper central incisors are about one-third wider from mesial to distal than the lower centrals. The upper central, therefore, occludes with the lower central, and also with from one-third to one-half of the lower lateral incisor. The upper lateral occludes with the remaining portion of the lower lateral, and the mesial portion of the lower cuspid. The upper cuspid is usually rather broader from mesial to distal than the lower, and in occlusion covers its distal two-thirds and about half of the lower first bicuspid so that its lingual, or triangular ridge, is between the cusp of the lower cuspid and the buccal cusp of the lower first bicuspid, the point of its cusp overlapping the lower teeth. The buccal cusp of the lower first bicuspid occludes in the space between the upper cuspid and the upper first bicuspid. This order is now maintained between the bicuspids. The buccal cusp of the upper first bicuspid overlaps (to the buccal) the space between the two lower bicuspids, and its lingual cusp occludes in the sulcus between them, while the buccal cusp of the lower second bicuspid occludes in the sulcus between the two upper bicuspids. The cusps of the upper second bicuspid occludes between the lower second bicuspid and lower first molar. The broad surfaces of the molars

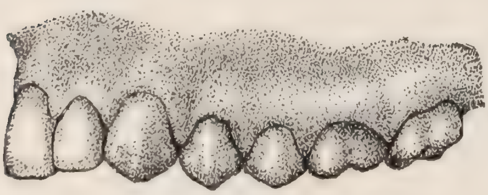
come together, so that the mesial two-thirds of the upper first molar covers the distal two-thirds of the lower first molar; and the distal third of the upper first molar covers the mesial third of the lower second molar. This brings the transverse ridge of the upper molar between these two lower teeth. This order is continued between the remaining molars, but less perfectly as the teeth are more irregularly formed. The upper third molar is usually smaller than the lower third molar, yet it generally extends over its distal surface.

"The **inclination of the teeth** is the deviation of their long axes from the perpendicular line. The direction of the inclination is expressed by some accompanying word. The upper incisors and cuspids are so arranged that their crowns are inclined more or less forward, or towards the lip, and slightly towards the median line. The mesial inclination is continued in the bicuspids and molars, diminishing from before backward, and is usually lost at the second or third molar. As a rule, the bicuspids and molars of the upper jaw are also slightly inclined towards the cheek, but in many dentures this inclination is slight, or wanting in the bicuspids and first molars, to re-appear in the second and third molars, though it may be absent even in these without necessary malformation.

"The **lower incisors** and **cuspids** are also inclined with their crowns towards the lip, but in less degree than the upper. And even the perpendicular position of these is not inconsistent with a normal arrangement. They have, however, a mesial inclination, but usually much less than the corresponding upper teeth. The **lower bicuspids,** within the limits of the normal arrangement, vary considerably in their inclinations. Sometimes they have a strong mesial inclination, and at other times they are nearly or quite perpendicular. In many dentures, they also have a lingual inclination, but may be perpendicular or even have a slight buccal inclination. The **lower molars** usually have a slight mesial or lingual inclination. In many examples, however, the mesial inclination is wanting, especially in the second and third molars.

"All the teeth are a little broader from mesial to distal at or near the occluding surfaces than at their necks. Therefore, when arranged in the arch with their proximate surfaces in contact, there is a considerable space between their necks (Fig. 2). These are known as the **interproximate,** or **V**-shaped, **spaces.** The sharp angle or apex of the **V**-form is toward the occluding surface or at the contact point of the proximation, and the open end or base is at the crest of the alveolar process. In normal conditions, this space is filled by the soft tissues, or gums (Fig. 6). The average arch measures about 127 millimeters (5 inches) from the distal surface of the right third molar to the distal surface of the left third molar, following the curve of the arch. This represents the average mesio-distal measurement of the crowns of the teeth of the upper jaw taken collectively. The average measurement

Fig. 6.



of the teeth at their necks is about 89 millimeters (3.5 inches). The remaining 38 millimeters (1.5 inches) represent the average sum of the **interproximate spaces** taken collectively.

"On account of the difference in the **conformation of the crowns** and the **inclination of the teeth,** the interproximate spaces vary much in width in different dentures. They are much wider between bell-crowned teeth than between thick-necked teeth; but some interproximate space exists in every normal denture. When the crowns of the incisors and cuspids are much inclined towards the lip, the necks of the teeth form a smaller circle than the line of the contact points of the proximation, and in this way the interproximate space is wide between the necks of the central incisors. The suture joining the maxillary bones passes between the roots of these teeth, and they are somewhat farther apart than the roots of the central and lateral incisors, or those of the lateral incisors and the cuspid. Therefore, in these latter, the interproximate spaces are of less width. Between the bicuspids the interproximate spaces are wider at the necks of the teeth than between the anterior teeth, on account of the greater breadth of the crowns as compared with the roots. The widest interproximate spaces are usually between the necks of the molars.

"The **points of proximate contact** in the best formed arches are near the occluding surfaces of the teeth. In imperfectly developed teeth, in which the crowns are much rounded towards the occluding surfaces, the contact points are more toward the gingival. In the incisors and cuspids they are in direct line with the cutting edges. In the bicuspids the contact is near the buccal angles and nearly in line with the buccal cusps.

"The mesial and distal flattened surfaces of these teeth converge to the lingual to such an extent that, though they are arranged in arch form, the contact points remain close to the buccal angles. In many excellent dentures there is a decided interproximate space opening to the **lingual,** but in thick-necked teeth and those of a more rounded contour the contact points are often more toward the lingual, and there is no appreciable lingual interproximate space. In the molars the contact points, as a rule, are removed rather to the lingual, but still in the best formed dentures they will be found nearly in line with the buccal cusps. Between the upper first and second molars the contact point is often extended toward the lingual by the prominent disto-lingual cusp of the first molar; and, even when otherwise the general rounding of the distal surfaces of the upper molars often brings the contact points near the middle line of the teeth. In lower first molars the large distal cusp brings the contact point with the second molar close to the buccal side, with a considerable lingual interproximate space. If the distal cusp is small the contact point is usually extended toward the lingual, often as far as half the bucco-lingual breadth of the teeth. Between the second and third molars the contact point is more frequently near the central line of the teeth. In the best formed dentures the **form** of the **proximate** contact is such as to pre-

vent food from being crowded between the teeth in mastication; and, therefore, such as to keep these spaces clean and the interproximate gingivus in health. But many **faulty forms** are met with which allow food to leak through into the interproximate space and crowd the gums away, forming a pocket for the lodgement of debris, giving opportunity for decomposition, and resulting in caries of the proximate surfaces, or disease of the gum and peridental membrane. **Exceptionally, cases are met with** in which the teeth stand so widely apart that the spaces are self-cleaning. The form of the interproximate spaces is very variable. It is best studied in skulls in which the teeth are all present, and by careful consideration of the forms of the proximate surfaces of the teeth, together with their relative positions.

THE ALVEOLAR PROCESS AND ALVEOLI

Fig. 7.

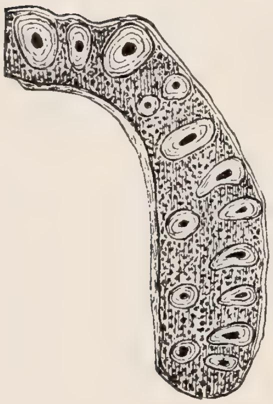
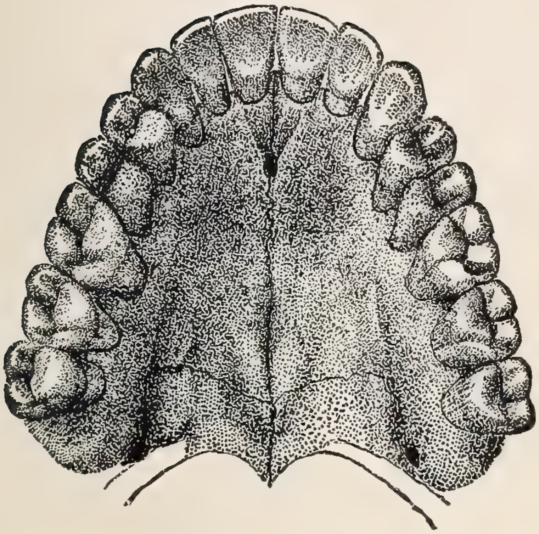


Fig. 8.

"The **alveolar process** is the projecting portion of the maxillary bones within which the roots of the teeth are lodged in alveoli, or sockets, accurately fitted to their surfaces (Figs. 7 and 8). The form of the alveolar process seems to depend on the teeth, the conformation of their roots, and their arrangement in the arch. If any teeth are misplaced, or from any cause stand out of the regular and normal line, the alveolar process is formed about their roots in this irregular position. Also, when teeth are lost, the alveolar process mostly disappears by absorption, and the remaining portions of the alveoli are filled with bone.

"**Normally,** the alveolar process envelops the roots of the teeth to within a short distance of the gingival line (Figs. 2 and 9), varying from one to three millimeters in the young adult. This distance increases somewhat with increasing age. The borders of the alveolar process are reduced to a thin edge about the necks of the teeth on both the labial and lingual sides of the incisors and cuspids of the upper jaw. About the lingual sides of the necks of the bicuspids and molars the borders are also reduced to a thin edge, becoming slightly thickened about the second and third molars, especially of the latter. On the buccal sides of these, a thickening of the immediate borders of the alveolar process, in the form of a marked ridge, begins about the first or second bicuspid, more commonly between these two, and extends to the distal of the third molar (Fig. 2, a). This ridge varies in different examples, from a very slight thickening of the immediate border, to a thickness of two or three millimeters. It forms a border standing squarely out from the necks of the teeth. The alveolar process then thins away so that, in many instances, the buccal roots of the teeth, especially the

Fig. 9.



mesial root of the first molar, have but a thin covering of bone.

"**Anteriorly**, the bony covering of the roots of the upper incisors presents much variety. In some examples, the middle portion of the roots has but a slight covering of bone, but more generally it is progressively thickened from the neck to the apex. The roots of the cuspids are prominent towards the lip, and, for most of their length, have only a thin bony covering, and this forms a ridge along the line of the root, which may easily be traced with the finger through the soft tissues of both the gum and lip. In many instances the bony covering is entirely wanting for a little space near the middle of the length of the root of the cuspid, the buccal root of the first bicuspid, the mesial root of the first molar, and, occasionally, of other teeth.

"On the **lingual side** of the upper teeth (Fig. 9), the progressive thickening of the alveolar process, from the border towards the apex of the root, is much greater; so that the roots of the teeth seem to lie towards the labial and buccal side of the alveolar process (Fig. 7). Even the large lingual root of the upper first molar, diverging strongly to the lingual, seldom forms a ridge or prominence of the process covering its lingual surface."

CHAPTER XI

"TYPICAL AND ATYPICAL OCCLUSION OF THE TEETH IN RELATION TO THE CORRECTION OF IRREGULARITIES"

The following chapter is an extract from a paper entitled as above, by Dr. Matthew H. Cryer, Professor of Oral Surgery in the University of Pennsylvania, read before the New York State Dental Society, May, 1904, and published in the Dental Cosmos, September, 1904.

It should be carefully studied in its general and scientific teaching of the anatomical, physiological, and surgical aspects of the teeth in relation to Orthodontia. The teachings of men of Dr. Cryer's long experience and eminence in the dental profession, relative to the principles of tooth movement and regulation, should receive the profoundest consideration. Attention is particularly called to his opinions in regard to some phases of the recently exploited theory of regulating all cases without extraction, upon the basis that "the most esthetic facial outlines are dependent upon the production of a typically normal occlusion."

EXTRACT FROM DR. CRYER'S PAPER

"During the past three years many papers have been published on the subject of irregularities of the teeth and their treatment, and while some of them are of unquestionable value, covering points of capital importance in the field of Orthodontia, the author feels, however, that due consideration has not always been given to the outlines of the face which are molded upon the topographical anatomy of the facial bones, the alveolar processes, and the teeth.

"Some writers have given fixed rules for changing the position of the teeth, without bearing in mind the fact that each case demands the adoption of a special mode of procedure in its treatment. This wholesale correction by rule is causing many of the young members of the profession to perform operations which are damaging to the patient and which cannot be rectified in later years. It is for this reason that the writer desired to present a paper which would bring out a general discussion upon 'Typical and Atypical Occlusion of the Teeth.'

"In the correction of irregularities of the teeth and their processes, three fundamental principles should always be considered. First, the operator should carefully regard the outlines of the face, especially as they should appear in early adult life; the difference in treatment demanded by the male and female type should be observed; the variations in each individual should be considered, and each case treated according to its own requirements. Second, due consideration

should be given to the appearance of the teeth when the lips are open, as in talking and laughing. Third, the importance of occlusion in regard to vocalization, appearance, and mastication. As malocclusion often brings serious pathological conditions, such as impacted teeth, neuralgia, etc., this condition should receive most careful attention. It is the writer's opinion that the surgeon should have a full knowledge of the superficial and internal anatomy of the maxillary bones, with that of the alveolar process, which is only the connecting structure between the teeth and the bones proper. He should also be thoroughly conversant with the physiology of this region and with the pathological changes of which it may become the seat.

Typical vs. Actual Anatomy and Occlusion

"After close study of the forms of various bones of the human skeleton, both disarticulated and articulated, and the open spaces of the face, such as the oral cavity, the orbits, the nasal chamber with its associated pneumatic sinuses and cells, etc., the writer came to the conclusion that typical anatomy as taught in text-books is more ideal than true, and is something different from that with which the surgeon comes into daily contact, and it is his opinion that this divergence applies to a notable extent in reference to the jaws and teeth at rest and in occlusion.

"In order to bear out this statement a few illustrations will be given showing the typical anatomy of the external and internal structures of the jaws and the occlusion of the teeth.

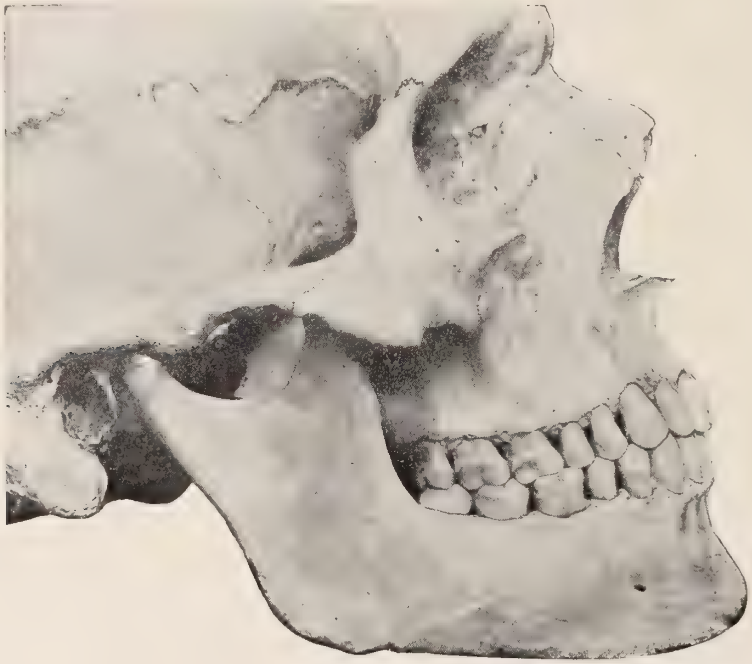
Fig. 10.

Upper and lower jaws of a negro skull, showing considerable prognathism.

"The illustration Fig. 10 is from a slide kindly loaned by Dr. I. N. Broomell, from a photograph of a negro skull which is in his possession. The reason for showing this picture is the fact that various authors give it as an illustration of

normal occlusion of the teeth, omitting to state that it is from the **negro race** — in other words, that it belongs to a race more or less prognathic. The occlusion of the anterior teeth shows that it belongs to this type of skull; it is a fine specimen, except that the upper second and third molars do not occlude typically with the lower third molars, even according to the negro type.

Fig. 11.



Side view of upper and lower jaws of a Caucasian skull, showing typical occlusion of the teeth.

"Fig. 11 is a side view made from an almost perfect skull of a white woman. The teeth are so nearly typical in occlusion that but a few persons have found any fault with the specimen. The incisor teeth may possibly protrude too much to be in harmony with some Caucasian faces. The teeth, especially the anterior ones, must be in harmony with the general outline of the face and lips. In the general occlusion it will be found that each tooth of the upper jaw comes into contact with two teeth of the lower jaw, except the third molar, while each tooth of the lower jaw comes into contact with two of the upper teeth, except the central incisors. The interlocking of the premolars and the molar teeth is ideal.

"Some orthodontists speak of moving the teeth inward, outward, forward, or backward, as though they were dealing with plain porcelain teeth set up in wax on a mechanical articulator, without taking into consideration the anatomy, physiology, or pathological conditions presented in the jaws or the general system.

"The writer can readily understand how teeth can be moved forward, as a rule, by orthodontists, as that is the direction of their general or usual movement during development or eruption into their proper positions. But he doubts the ability of any man to successfully move a lower first molar backward half its width when the other molars are in position. It may be possible — though it is some-

what doubtful — for the lower first molar to be moved half its width backward in the mouth of a child about seven or eight years of age, but your essayist fears serious results even in such a case.

Fig. 12.

Side view of the upper and lower jaws of a child about seven or eight years of age, showing the deciduous teeth, the first molars, and the germs of other permanent teeth.

"Fig. 12 is from a specimen of jaws belonging to a child seven or eight years old. We find all the deciduous teeth in position, also the first molar. The developing crown of the second molar is just posterior to it. The germ of the third molar is not shown. Suppose it were possible to move the first molar backward half its width, would it not interfere very materially with the second molar by disturbing its true position — by carrying it backward and turning it over to a greater or less extent?

Fig. 13.

Side view of upper and lower jaws of a child about twelve or thirteen years of age.

"Fig. 13 is from a similar preparation, of a child about twelve or thirteen years of age. If the first molar had been moved backward half its width, at the age of seven or eight years, the second molar would have been carried back with it. This would not have allowed proper space for the third molar, which would more than likely have become impacted.

Fig. 14.

From a radiograph taken from a cleaned specimen of the left side of the lower jaw, showing an impacted third molar.

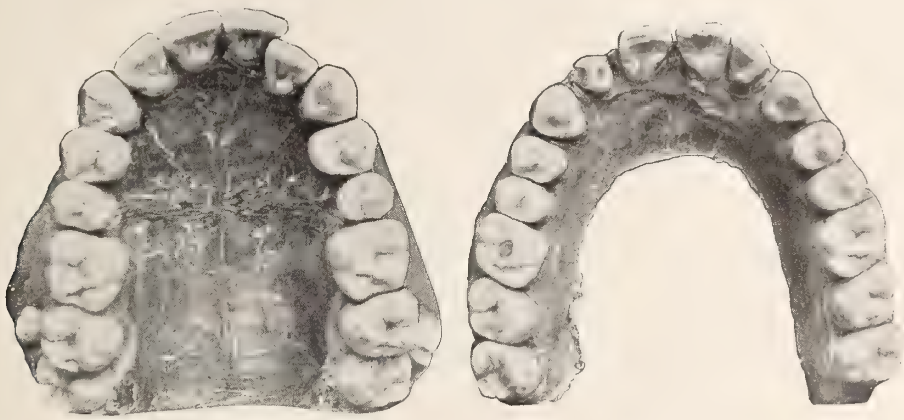
"Fig. 14 is a radiograph taken from a cleaned specimen of the left side of the lower jaw showing the teeth in their position with the cancellated tissue. One might well imagine that a modern orthodontist had moved the first molar half its width backward or held it in such a manner that it could not advance. Whether this was done by a mechanical appliance or was the result of pathological causes, the tooth was held and impaction resulted. If the cancellated tissue be examined, as seen in the X-ray picture, it will be noticed that it is more dense around the first and second molars than anteriorly to these teeth. As the result of an inflammatory condition the cancellated tissue has become united with the cortical bone, thus making another factor in preventing its sliding forward. It will be noticed that the roots of the molar teeth are also thickened by the over-action of the cementoblasts caused by this inflammatory condition.

Extraction for the Correction of Irregularities

"Many writers, especially of late, claim that irregularities of the teeth should always be corrected without the extraction of one or more teeth, as 'Nature

never puts teeth into a mouth that do not belong to that physiognomy.' Your writer thinks this is doing Nature a great injustice; many teeth are found within the mouth which should be removed, not only for the correction of irregularities but for the general comfort and health of the patient. Modern civilization demands that we live contrary to rather than in accordance with Nature, and so long as this is so, we cannot blame Nature for existing irregularities or depend entirely upon her for beneficent results. Our numerous dental and medical colleges testify to the necessity of assisting Nature to become reconciled with modern methods of living.

Fig. 15.



A B

Made from two upper jaws, showing a large amount of tooth tissue in the smaller jaw, A, and much less in the larger jaw, B.

"Fig. 15 is made from two photographs of upper jaws taken on the same plate. These pictures are to demonstrate that a small jaw can be crowded with large teeth, while a large jaw may have small teeth with space between them. It has been given as a reason for this condition that a child may inherit the jaw of one parent and the teeth of another, and for lack of a better explanation it may be well to accept this one for the present.

"From a practical standpoint it matters not why such irregularities exist; they are there, and must be corrected. Notice the size of the teeth in the left picture. Beginning with the incisors and passing backward, the first bicuspid is extraordinarily large, as are also the molar teeth; there seems to be too much tooth tissue, as in addition two rudimentary fourth molars can also be seen. What would the non-extractor do with these two teeth? Would he endeavor to place them in their regular position, as shown in the illustration Fig. 19, or would he not rather acknowledge that these teeth should be extracted because they interfere with the general hygiene of the mouth?

"Fig. 16 is a lateral view of the left picture of Fig. 15. The teeth are in occlusion with its mate, the lower jaw. It has been claimed by many that if the first molars or bicuspids be properly locked, the other teeth will be in good occlusion The writer cannot agree with these two assertions. The illustration before us shows that the first and second molars of each jaw are typical in occlusion as

well as the bicuspids. (The molars and bicuspids on the opposite side are in equally good occlusion.) If the above rules are to be followed, then the canine

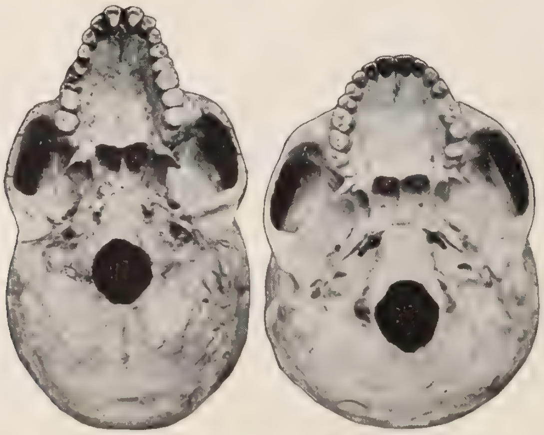
Fig. 16.

Upper and lower jaws in occlusion.

and incisor teeth should be correct, but they are not to be found so in the skull from which this illustration was taken. The incisors are in occlusion, edge to edge, instead of the upper one overlapping the lower one. A large amount of tooth tissue was shown in the upper jaw, and a large quantity in proportion in the lower jaw. In order to have had proper occlusion it would have been necessary to have lost tooth tissue laterally, in the lower jaw. If this be granted, then the question arises, When should it have been lost, and what tooth or teeth should have been extracted?

Characteristic Features of Caucasian and Negro Skulls

Fig. 17.



View of the under surfaces of skulls, showing difference between Fan Tribe West African skull and the Caucasian.

"Fig. 17 is made from the under surface of two skulls. The one on the left is that of a Fan Tribe West African, the other is from a Caucasian. They differ

greatly in the shape of the roof of the mouth and the line of the occluding surfaces of the teeth. For these types of skulls they are normal in the arrangement of the teeth, with the exception of those lost by decay. The line of the occluding surfaces of the white skull is too nearly circular, however, to be termed typical. The special difference in these skulls is this: In the negro, if the outer line of the zygomatic arch be carried around until it intersects the teeth, that line will be near the anterior surface of the second molars; while in the other skull the line would be in front of the first molar, showing that the teeth are carried forward in the negro skull the width of a molar tooth.

Fig. 18.

Two mandibles — A, from a Fan Tribe West African negro; B, from a Caucasian, showing difference in position of teeth relative to the ramus, mental foramen, and symphysis menti.

"Fig. 18 is made from two mandibles. The upper one is from the same Fan Tribe negro as shown in Fig. 17; the lower one is from another Caucasian skull. If the position of the third molar of the negro jaw be examined, it will be seen that there is room for another molar back of the third, while in the mandible of the white skull the third molar is far back, leaving no room for another tooth. In the negro jaw the mental foramen will be found below the first molar, while in the white jaw it is on a line drawn downward from between the bicuspids, showing again that in the negro skull the teeth are carried forward about the width of a molar tooth.

Fig. 19.

Side view of a prognathous negro skull with eighteen teeth in the upper jaw.

"Fig. 19 is from the skull of another negro who died while in the Philadelphia Hospital. The prognathism is not so marked as in the one belonging to the Fan Tribe West African. The mental foramen in this case is situated on a line between the second bicuspid and the first molar. In the upper jaw there are eighteen teeth, the two most distal being rudimentary fourth molars. Barring these fourth molars, all the other teeth are in good occlusion. If this condition of the teeth were exhibited in the white race, which would give the appearance of that shown in the next figure, it would be good surgery to remove the upper and lower bicuspids or the upper and lower first molars on each side.

Prognathous Appearance Caused by Hypertrophied Gums and Alveolar Processes

"Not having an anatomical specimen showing this kind of prognathism, your essayist has taken the liberty to show Fig. 20, which was made from the

Fig. 20.

From photograph of a lad suffering from hypertrophy of the gums and alveolar process.

photograph of a boy about fifteen years old. When this picture was shown to one of our leading orthodontists, he declared it was that of a degenerate. The boy had a most marked hypertrophied condition of the gums and alveolar process of both jaws, which protruded forward. It was thought advisable to remove the alveolar process along with the teeth and gums, which gave him the appearance shown in the next picture.

Fig. 21.

From photograph taken three weeks after removal of the pathological tissue.

"Fig. 21 was taken three weeks after the operation. The prognathism is lost, leaving somewhat sunken cheeks.

Fig. 22.

From photograph taken six years after operation upon the person represented in Fig. 20.

"Five years afterward he had a picture taken shown in Fig. 22. No one would claim that this picture was that of a degenerate.

"These last three illustrations have been exhibited in order to justify the removal of gum, tooth, and alveolar tissue, or even bone, to correct such deformities, even if artificial teeth have to be worn afterward."

CHAPTER XII

PRINCIPLES OF OCCLUSION AND DENTO-FACIAL RELATION, INCLUDING A REVIEW OF THE "NEW SCHOOL" TEACHINGS *

Occlusal Relations

In the correction of all irregularities of the teeth with a view to their future usefulness and permanency of retention, **occlusion** is one of the most important factors for consideration in diagnosis and prognosis.

In every case where the masticating teeth have established a fixed occluding position with cusps that interlock or interdigitate, whether it be typically normal in its relations or not, any change of that position necessary for the accomplishment of correction should place them in a new occlusal adjustment of self-fixation; else Nature, either in her forceful efforts to perfect the function of mastication, or in response to the law of heredity, will mar or wholly destroy the perfect results of treatment, even though they be artificially retained for years.

In cases where one or more teeth of either jaw are crowded out of arch alignment, or are malturned and overlapping, if held in that position by the fixed occlusion of other teeth, any movement to accommodate them that is destined to affect the relative positions of the bicuspids or molars will usually require a concomitant movement of the occluding teeth of the opposing jaw.

In a large proportion of irregularities for youths there will be found no marked dento-facial inharmony; and even those facial imperfections that are caused by a malrelation of the teeth in occlusion will frequently disappear upon proper corrective treatment after being followed by the harmonizing influences of growth. Therefore in all of these cases, however jumbled the irregularity, the rule should be **imperative** that we strive to produce a **typically normal occlusion** — an attainment that is impossible where teeth are extracted merely to simplify the operation or under the mistaken impression that regulation cannot otherwise be accomplished.

This does not mean that the principal and only object in practice is to attain to the production of a **normal occlusion** at the expense of producing or retaining a **facial deformity**; and especially when by the extraction of the first or second bicuspids we can place the operation within sure and easy possibilities of correcting the facial deformity and leave the patient with a good masticating occlusion — often so perfect that only an expert is able to discover that teeth are missing. Nor does it mean that the correction of the facial deformity or imperfection should

*Case — Items of Interest, July, 1905.

be accomplished, if possible, at the expense of a **masticating occlusion,** whose cusps interdigitate. One is quite as important as the other. The facial relations should be considered first, because they frequently **mark the course** that should be pursued in the correction of the dental irregularity and occlusion, with the concomitant correction of the facial outlines. They tell us whether we should move the upper or the lower teeth, or both, and also the relative amount of movement demanded; or whether the desired correction is impossible or inadvisable without extraction. The failure to extract teeth when demanded is quite as much malpractice as the extraction of teeth when not demanded.

In the contemplation of obtaining room for the correction of malposed teeth, or for the freer eruption of the permanent teeth of youths by the expansion of immature arches, or by the extraction of temporary or permanent teeth, the harmonizing influence of growth with the natural enlargement of the alveolar arches should never be lost sight of. If dentists would give more thought to this subject, and to the possibilities of judiciously enlarging the arches in keeping with the present and future development of other parts, there would not be that ruthless and uncalled for interference and that wholesale malpractice of extraction that now disgraces the science of dentistry.

With modern methods and principles of applying force to the teeth, the dental arches can always be sufficiently and harmoniously enlarged — at both the occlusal and apical zones, if required — to place all of the teeth in the arch and in perfect alignment, however extensively malposed. Again with dental arches complete and in alignment the occlusion can always be adjusted laterally and disto-mesially so as to place the teeth, if need be, in a typically normal occlusion. Therefore, these phases of the question should never arise as an obstruction to correction without extraction. The only phase that should be considered under these circumstances is: Does the present condition, or will the future enlargements of growth, demand or permit the requisite expansion of the arch or arches for the production of a normal occlusion, **that will not ultimately leave a dento-facial protrusion.**

Importance of Dr. Angle's Teaching

While it is probably a fact that the true anatomical relations of normal dental occlusion has long been well understood by dentists, and the importance of striving for its attainment in the correction of irregularities of the teeth has been dwelt upon by numberless writers and published by dental journals and text-books, it has nevertheless remained for Dr. Edward H. Angle of St. Louis, in his very admirable work entitled "Malocclusion of the Teeth and Fractures of the Maxillæ" to present this phase of the subject in so forcible a manner that the dental profession — or at least that part of it who essay the regulation of teeth — have awakened to a fuller appreciation of its importance as a guide to correction and as a means of permanency of retention.

He places the occlusal relations of the first permanent molars as the real guide posts in diagnosis for determining the general relations of occlusion. This should meet with the hearty approbation of all experienced orthodontists. **First:** Because the occlusal relations of the first permanent molars are usually in distinct evidence when other teeth which might be used as guides have not erupted, or are in decided malalignment. **Second:** The first permanent molars are the true basis of their respective dental arches, the relative antero-posterior positions of which are largely influenced by the relative mesio-distal positions which these teeth assume in the jaws. **Third:** With a very large proportion of all human beings — and especially those to whom there have occurred no abnormal disturbances in secondary dentition — the occlusion of the teeth is that which we have learned to recognize as typically normal, while the sizes and general positions in Caucasian races are in comparative harmony with the physiognomies in which they are placed, so that we have always before us a fairly perfect type of normal occlusion and esthetic dento-facial relations. **Fourth:** It being true that the relative mesio-distal positions of buccal teeth are dependent upon those of the first permanent molars, in connection with the fact that the first permanent molars are often subjected to early influences — such as the premature loss of deciduous teeth, etc.,— which causes them to shift their otherwise normal positions in the arch, we are led at once to the importance of preserving or establishing **early** the normality of these natural piers to the future arches, in order that normal occlusion, natural esthetic dento-facial relations and permanency of retention be attained in the correction of irregularities.

But it should be remembered that this is but **one** of the basic principles in orthodontia, and that it refers **only** to that important class of irregularities in which the natural or inherited disto-mesial relation of the buccal teeth are — or were intended to be in the individual — in harmony with all dependent physical structures, and that correction with the proper maintenance or attainment of a normal occlusion without the loss of permanent teeth is indispensable to normal dento-facial relations.

This covers so large a class of irregularities that are met with in practice, and for which the proper correction of occlusion without extraction is the only true treatment, that many in following its teachings with happy results have unfortunately been lead to believe in its unlimited applicability.

As the hypothesis that the attainment of a normal occlusion in every case is the *ne plus ultra* of Orthodontia, and as definite mathematical rules have been laid down* for the movement of teeth to accomplish this result in extensive and minor malocclusions, which seemed to place the science of regulating teeth within the easy grasp of all minds, it is not strange that it should be considered a great discovery, and especially by men of limited experience.

* Angle. See page 167.

Teachings of the New School

The teaching that "**Normal Occlusion**" — or, in other words, **Typical Occlusion** with a full complement of teeth — is **imperative** and **necessary** for the most perfect dental and facial results in Orthodontia has taken such hold of the dental profession, or that portion of it who desire to regulate teeth, that the author has deemed it advisable to point out in this and the subsequent chapters some of its errors which are liable to lead to imperfect results, if not to actual malpractice; and to show that outside of the important class of malpositions to which it most certainly applies, many conditions arise that demand the scientific application of other equally important principles of reasoning and treatment along distinctly different lines.

Upon this new system of practice, based upon what I shall attempt to show is an erroneous theory of normal dento-facial harmony, has arisen the so-called "New School of Orthodontia," which teaches:—

"That extraction is wrong. That the full complement of teeth is necessary to the best results, and that each tooth shall be made to assume its correct relations with its fellows."* Dr. Angle further says: "I shall try to impress you from the orthodontist's standpoint with the value of each individual tooth and with the **absolute necessity** of preserving the full complement of teeth, or its equivalent in **every case.** I shall try to bring conclusive evidence that the sacrifice of teeth for either the intended prevention or correction of malocclusion is not only wrong practice and fallacious teaching, but most baneful in its results. I shall further try to show that the full complement of teeth is necessary to establish the most pleasing harmony of the facial lines."

Dr. Angle, in outlining the treatment of upper protrusions and all cases where the upper molars and bicuspids occlude mesially to normal, **even after the eruption of the second molars,** says: "If the molars and premolars of the upper dental arch be moved distally one-half the width of a cusp of a molar or premolar, and the molars and premolars of the lower arch be tipped forward in their alveoli to the same extent, or one-half the width of a cusp of a molar or a premolar, there will then be normal mesio-distal relations of the teeth, and if the arches in the region of the incisors be put in true at the same time, there will be harmony in their relations **and the best effect will have been produced upon the facial lines.** In other words, **we will have established normal occlusion with all its possible benefits.** This plan of treatment I have been practicing now but three years, and so pleased am I with it in the large number of cases that I have so treated that I no longer practice or believe in the plans that I formerly advocated, or that of gaining harmony in the sizes of the arches by the sacrifice of the two first premolars in the upper arch," † etc.

* Angle — New York State Dental Association, 1903. Published in the International Dental Journal, October, 1903, pages 730 and 749.

† Angle — International Dental Journal, October, 1903, page 749.

The particular phase of the theory which premises that normal dental occlusion is **incompatible** with irregularity or imperfection in contiguous facial outlines has been extensively exploited by the "new school," but in no place has the author seen it so completely and concisely stated as from the pen of Dr. H. A. Pullen * of Buffalo, New York, as follows:

"The facial lines are dependent upon the normal occlusion for their normal relationship, hence the occlusion is the factor of prime importance rather than the facial lines.

"Shall we diagnose a case of irregularity from symptoms which disappear upon proper treatment of the occlusal relations of the teeth?

"We would have it understood that normal occlusion is incompatible with any degree of irregularity, and with this ideal relationship, normal occlusion and normal facial lines are inseparable.

"In the diagnosis of any case of malocclusion, the occlusion is first noted and then the variation of the facial lines from the normal is considered as **caused** by a variation from the normal occlusion, and **is therefore a symptom of faulty occlusion.**"

The Author's Teaching

The author has endeavored to make this so-called "modern teaching" authentically plain, before proceeding to point out his reasons for believing that in its principal mandates it is a **false teaching,** which if indulged in by any considerable portion of the profession, it cannot help but retard the science of Orthopedic Dentistry.

It will be observed in this teaching that the standard of dental perfection is **Normal Occlusion,** which it is claimed is "incompatible with abnormal facial outlines." In the author's practice and teaching the standard of dental perfection is "**Dento-Facial Harmony**" or "**Normal Dento-Facial Relation,**" which in the correction of irregularities **includes** "normal occlusion" whenever the presence of all the teeth is demanded; but always an occlusion whose cusps interlock or interdigitate, else function and retention would not be assured.

A Study of Normal Occlusion in its Relations to Treatment

What is "Normal Occlusion" of the teeth and its influence in Orthodontia? We have recently been told that even among the dental profession "probably less than three per cent know the correct occlusion of the teeth individually or collective." †

In the author's opinion, no educated dentist in this age needs to be told what normal occlusion of the teeth practically consists in; nor of its importance in

* Pullen — Items of Interest, July, 1904, page 541.
† Angle — International Dental Journal, page 733

every branch of dentistry. Furthermore, the true anatomical and physiological principles of normal occlusion, *per se*, in its important relation to Orthodontia can hardly be called a "discovery" of recent years. One has but to carefully peruse the very first works of any note upon Orthodontia, i. e., **Oral Deformities** by Dr. Norman Kingsley, published in 1880, and **Irregularities of the Teeth** by Dr. J. N. Farrar, published in 1888, to become convinced that the importance of restoring the teeth when demanded to a normal occlusion in Orthodontia was fully appreciated and one of the principal factors of treatment by some of the leading minds then as now. And since that time in all the teachings and practices of prominent orthodontists it has been such **a self-evident principle** in the regulation and retention of teeth, it seemed almost out of place to ring changes upon it, as perhaps should have been done for the benefit of that large majority who are slow to grasp the underlying principles of every department of dentistry.

The reason that this principle has suddenly sprung into prominence as something hitherto unknown or unappreciated is because the **awakened ones** have been led to believe that in the attainment of a normal occlusion — which can be accomplished without extraction — lies the whole secret of the science of regulating teeth. The subject is therefore worthy of a careful and intelligent examination by every student of Orthodontia.

Normal, Typical, or Anatomical Occlusion is fully described by Dr. G. V. Black in Chapter X, published by him in 1892.

The perfect type of **normal occlusion** is beautifully illustrated in Dr. Cryer's collection of skulls. Let us select that shown in Fig. 10, page 117, because it is the one which Dr. Angle and others have selected to represent **normal occlusion.*** Consequently it must have been a typically perfect specimen — as it most certainly is. But it is from a photograph of a *negro* skull, and while looking at it we can readily see — in the mind's eye — the characteristic prognathism of contiguous tissues and facial lines. Should the same character of occlusion with protruding relations of the teeth to the jaws occur in an otherwise perfect Anglo-Saxon type — *as it certainly does* even to a greater extent — it would produce a facial effect that could not be diagnosed otherwise than a protrusion of the upper and lower teeth, demanding treatment.

In the Dental Cosmos for February, 1905, Dr. Cryer, in speaking of this same Fig. 10, says: "It is certainly normal to that particular negro, but it would be just as reasonable to give the occlusion of a horse, or a dog, and state that they are normal. The point is this: modern orthodontists show upon the screen a profile portrait of an Apollo-Belvedere as an illustration of manly beauty, and then follow it with Fig. 10 — the skull of a prognathous negro — as an illustration of normal occlusion."

Fig. 20, p. 124 in Dr. Cryer's paper shows an extreme full upper and lower protrusion in an Anglo-Saxon type of physiognomy. There is no reason to suppose

* Angle — "Malocclusion of the Teeth and Fractures of the Maxillæ."

that the teeth were not in normal occlusion, as is frequently seen in less pronounced bimaxillary protrusions. We can also well imagine that the lower jaw of this patient, if dissected, would look quite like "A," Fig. 18, p. 123 as compared to "B," and in occlusion similar to Fig. 19, p. 124.

In view of the above, is the statement of any scientific value "that the full complement of teeth is necessary to establish the most pleasing harmony of the facial lines," or "that normal occlusion is incompatible with any degree of irregularity," and that "normal occlusion and normal facial lines are inseparable"?

If this were an argument of a case to be decided by an intelligent jury, we could safely rest here without another plea, because the above presentment alone is sufficient in itself to disprove the theory that a "normal occlusion" with a full complement of teeth is indicative of the most pleasing facial outlines that is possible with the particular type in question; and therefore, whatever the dento-facial deformity, "every case" should be corrected without extraction and the teeth brought to a normal occlusion.

In other places the author has endeavored to teach that which may be verified to the satisfaction of any inquiring mind by an examination of dental and facial relations everywhere to be found in the people about us, viz., that inharmonies, not uncommonly to the extent of decided facial deformities, quite as frequently and extensively exist with teeth in normal occlusion as with any of the other organs — the eyes, the ears, the nose — when compared to the physiognomy of which they form a part.

The teeth in normal occlusion may not be irregular in their relations to each other; but what is irregularity of the teeth, broadly and truly speaking, if it is not malposition of the teeth in relation to the facially esthetic, as well as the anatomical, and expressed by a dental marring or deforming of that perfect type which, from the birth of classic art, has appealed to the esthetic sense? On the other hand, what are the positions of teeth that produce facial deformities, if not in malposition and irregular?

With teeth in normal occlusion — or "normal" to the extent that the buccal teeth occlude in normal disto-mesial relations to each other — may be found a type of almost every class of irregularity. This relation of the teeth — which is Dr. Angle's Class I — may obtain in all Simple and Complex Irregularities shown in Part IV. It may also be found among many dento-facial irregularities: First, in Maleruption of the Cuspids (Type B, Class I). See Fig. 30, p. 155. Second: In Upper Protrusions (Type A, Class II). See Fig. 6, p. 286. Third: In Short and Close Bite Malocclusions, (shown under Type D, Class III). See Fig. 27, p. 323. Fourth: In Upper Retrusions (Type B, Class IV). See Fig. 38, p. 340. Fifth: In every type of Bimaxillary Protrusions and Retrusions (Classes V and VI). See Figs. 23, 24 and 25, pp. 134-136.

In the author's opinion the statement is irrefragable, that all of that large class of cases whose teeth are in normal occlusion, but with over-lying facial

contours protruded or retruded,— from that of malrelations that slightly mar the esthetic beauty of otherwise perfect or imperfect faces, to that of the most pronounced facial deformities that confront us,— **must be considered irregular, demanding correction,** if the science of Dental Orthopedia means anything beyond the correction of mechanical and anatomical occlusion for mastication alone.

Bimaxillary Protrusions and Retrusions

There are many reasons for discountenancing the teaching that a normal occlusion is indicative of perfection in facial outlines which has been denominated as one of the **basic principles** of the "new school."

Let us first consider a single simple reason, which every one must see, why this is not true, viz., In a case that otherwise would have been dento-facially perfect, the premature loss of deciduous teeth has permitted the upper and lower first molars erupting, or drifting forward, fully half the width of a bicuspid — and possibly more — and though in that unnatural position, their occlusal relations

Fig. 23.

may be perfectly normal, followed by the subsequently erupting buccal teeth. Now these teeth being the bases which have determined or are determining the antero-posterior positions of the other teeth in relation to the normal, if taken as guides because of their normal occlusion, and the teeth in front forced to alignment, **can the result be otherwise than an abnormal protrusion of both the upper and lower teeth in relation to the physiognomy?**

Fig. 23, which is one of many similar cases in the writer's practice, will

serve to illustrate this condition. It will be seen that the original disto-mesial occlusion of the buccal teeth is **normal**, and notwithstanding the fact that the labial teeth are thrown into malalignment, the overlying facial contours are decidedly protruding. As the arches are not materially contracted laterally, **could the alignment of the labial teeth — without extraction — do anything but enhance the already protruding facial outlines?**

The figure shows the same case after correction, with the first bicuspids — upper and lower — extracted; and notwithstanding the decided retrusion of the labial teeth and a slight retrusion of all the buccal teeth accomplished by a combination of occipital and intermaxillary forces, the facial protrusion is still not wholly reduced. (This case is further illustrated in Figs. 48 and 49, p. 181.) Therefore, though we have a typically **normal occlusion** — natural or produced —

Fig. 24.

it may be accompanied with one of the most marked dento-facial deformities; as is frequently seen in bimaxillary protrusions from constitutional or local causes.

These conditions in varying degrees — also bimaxillary **retrusions** of the upper and lower dental arches, with the same "normal occlusion"— we have about us everywhere; all of which are quite as susceptible of correction by orthopedic means as protrusions or retrusions of the upper and lower alone.

Perhaps some will say of the example cited, that the buccal teeth being in unnatural mesial malpositions should be retruded instead of a correction by extraction. That would be right if there were any way of determining that it was due to a **local cause**, providing that the conditions were not too extensive and the treatment commenced early. But in the majority of bimaxillary protrusions that present for treatment, the condition is due largely, if not wholly to constitutional causes, and in some of these cases that kind of treatment would

mean a retrusion of all the teeth, both upper and lower, fully the width of a bicuspid and possibly more, before the overlying protruding facial contours are brought to esthetic pose — an operation that would surely be a failure if attempted.

Fig. 24 is made from a few profile models of bimaxillary protruding types selected from many in the author's practice. The effect of a receding chin is quite apparent, but this is often wholly due to a comparison of immediate relations, and partly from the contraction of the thick muscular tissues that cover the point of the chin, which always occurs with the effort to close the lips forcibly; all of which quite frequently disappear upon proper treatment, as is well shown by comparing Dr. Cryer's Figs. 20 and 22 in Chapter XI. In all the five cases shown in Fig. 24, the buccal teeth were in normal disto-mesial occlusion, and in all, with the exception of one shown in Fig. 23, the teeth were in fair alignment.

Fig. 25.

Fig. 25 is made from the models of one of the above group of bimaxillary protruding types. It shows the common inclination of the labial teeth and normal occlusion of the buccal teeth found in this character of irregularity. It also shows the results of correction after the extraction of two upper and two lower bicuspids and a lower central incisor. Yet with the amount of retruding movement of the labial teeth that was permitted by so extensive an operation of extraction, the dento-facial outlines were still far too prominent for esthetic perfection. Had the retruding movement been carried further, the original effect of a receding chin would have been wholly removed, as would that peculiar expression of the physiognomy which has led many to denominate this type as arising from mental and physical degeneracy. I wish to say here that Fig. 25 was made from the plaster casts of one of the most refined and cultivated young women it has ever been my fortune to meet — the father a prominent lawyer, and

the mother far above the ordinary, and both with no apparent dento-facial imperfection, though widely dissimilar in the character of their physiognomies.

In Dr. Cryer's Figs. 10, 16, and 19, Chapter XI, will be seen the same inclination and normal occlusion of the teeth that is common in bimaxillary protrusions of the teeth. His Fig. 20 shows a characteristic profile of an excessive bimaxillary protrusion. Note the difference in the apparent prominence and relative attitude of the chin in his Fig. 22, which is wholly due to the retruding and harmonizing correction of the dento-facial area by surgical and prosthetic means, and which has perfectly resulted in a complete restoration of the normal expression of intellectuality.

When we remember that the marked dento-facial type of physiognomies shown in Fig. 24 is not so very rare, we must realize the probable frequency of the lesser conditions of bimaxillary protrusions, which characterize and proportionately mar the beauty and esthetic perfection of faces we meet. Because the teeth are in normal occlusion and alignment, and often beautiful, though much in evidence, while conscious that the person is homely or at least not attractive in appearance it is generally regarded as an inherited family type or unchangeable, with little or no thought of the possibility of correcting it by orthopedic means. And yet many of these lesser types may be frequently corrected even without extraction by a proper combination of occipital and intermaxillary forces.

One has but to closely and repeatedly study the facial outlines of people to become convinced that the dento-facial area, in one or more of its zones, is frequently not in esthetic relations to the balance of the features, — the forehead, malar prominences, and chin; and that one of the common conditions will be found to be a general protrusion, to a more or less extent, of the entire area that is supported by the teeth and alveolar process.

Influences of Heredity and Environment in Characterizing Facial Outlines

It may be accepted as incontrovertible that between the two extremes of a full bimaxillary protrusion on the one hand, and a full bimaxillary retrusion on the other, both with a typically normal occlusion, there will arise every gradation of lessened conditions toward the composite and esthetic type, all with normal occlusions of the teeth. In the composite of these extremes, as shown by the central profile of Fig. 54, p. 354, may be found a normal occlusion with dento-facial harmony, or it may be one in which the teeth, though thrown into decided complex irregularity, if corrected without extraction, will result in dento-facial harmony.

The inharmonies to esthetic facial outlines which are caused from malposed teeth are quite as diversified as inharmonies in size, form, and relation of the features of different physiognomies compared to the symmetrical. How often

do we see inharmoniously large noses placed upon faces whose entire features otherwise are built upon a far more delicate plan; and this is true, in varying degrees, of every feature and organ of the human body as compared to that which may be considered as the truly harmonious or symmetrically formed type.

The surface-contour, form, size, and varying positions of the features which compose the human physiognomy are largely dependent upon the osseous framework; which in turn is, normally, either an inherent type or the union of types which vary from harmony to the distinctively inharmonious. In all conditions of health and normality, these same influences and laws of development constitute the causes which govern and determine the relative sizes and forms of every organ and natural contour. From these sources have mainly arisen all the distinctively different types of races. While the laws and influences of environment, variation, natural and artificial selection, etc., are by no means ignored, the main cause of all physical peculiarities in organic forms is that of heredity.

In America, where the union of inharmonious types has had full sway, we find a great variety of inharmonies in the physical forms of its inhabitants. On the other hand, among people such as the Japanese and the Chinese, whose native countries are not so extensively encroached upon with the intermingling of foreign types, individual inharmonies and variations from the racial type are comparatively uncommon. And while their characteristic type, from our viewpoint, may be far from that which we recognize as the highest physical development in beauty and perfection of form, it nevertheless is that which has normally arisen under the influence of heredity, natural selection, and environment, and consequently to them it is a normal type.

One of the characteristic dento-facial types that is common with a Japanese physiognomy is a depression or unesthetic retrusion along the upper part of the upper lip, in which the base of the rarely, if ever, large nose rests. This depression heightens the usual pronounced malar prominences and shortens the somewhat thin upper lip in its relations to the incisal ends of the teeth — the lip itself approaching an angle of 45 degrees. In a number of cases which the author has examined, the disto-mesial relations of buccal teeth were normal in occlusion, while the labial teeth, particularly the incisors, were more labially inclined than we would consider esthetically normal. The cutting edges, especially of the upper incisors, were more or less protruding, which seemed to be due to a retrusion of the apical zone, or that which we would denominate from an esthetic standpoint, a repression of the normal development of the middle features of the physiognomy. If this condition, which is a normal Japanese type, occurred with an Anglo-Saxon, as it occasionally does, it would be diagnosed as decidedly abnormal, notwithstanding the perfect occlusion of the buccal teeth; and in all probability, if not an inherited type, it would be caused by some abnormal condition of the maxillary sinuses, resulting in a lack of development of the intermaxillary processes and demanding a protruding movement of the apical zone of the incisors

and a retruding movement of the incisal zone to correct the facial outlines. See Fig. 12, Type D, Class II.

It has long been recognized in the science of development that certain influences of environment which produced early functional derangements or diseases of certain organs of the body, characteristic of the locality (resulting in a lack of normal development of the part, or the stunted growth of the organ, or the undeveloped surrounding tissues which depended upon health for their normal growth), became in time an inherited type, slightly changing the physical form, yet sufficient to characterize the inhabitants of that locality.

Thus, repeated results affecting the physical form of the osseus framework from local causes may become normal results of heredity long after the original local cause has ceased to operate. This doubtless may be placed among the influences which have operated to characterize different races and peoples. A locality which particularly tended to produce early diseases of the naso-maxillary sinuses, which so frequently arise in all localities, resulting in a lack of normal growth of the surrounding bones which are dependent upon the health of the Schneiderian mucous membrane for their proper development, might in time produce an inherited characteristic type of physiognomies among unmixed and long located races, such as the Japanese.

How often do we see beautiful children from homely parents, because of the transmission to the child of those special features of the two physiognomies that harmonize in union? On the other hand, how often do we see plain and homely children from parents whose physiognomies individually are symmetrical and attractive, because of the transmission to the child of a combination of the features of both, which being dissimilar in size are inharmonious in union? And as the osseous framework is the principal medium that characterizes the various forms, even the large teeth of one parent and the small jaws of the other — though never claimed as more than of rare occurrence — will probably continue to be placed among the causes of irregularities by intelligent dentists, especially as it can be so easily verified.

Mesio-Distal Malocclusions

In those cases where the upper or the lower teeth occlude mesially or distally to normal in relation to opposing teeth, it may be stated as an unquestionable truth that the occlusal relation (as in all occlusions), does not indicate in itself either the character of the irregularity or the movement demanded for its correction; as it may be either a protrusion or a retrusion of the teeth of one jaw alone, — a condition quite as common as an equally reciprocal malposition of both. It doubtless is a fact, however (as will be explained), where the buccal teeth of one jaw are in decided mesial or distal relation to the normal, the opposing teeth have frequently been forced more or less by occlusion in the opposite direc-

tion. Therefore it should be well understood that a reciprocal movement of the upper and lower teeth with the intermaxillary, or any reciprocally acting force, that is not controlled to act according to the real demands of the case, but only for the purpose of producing **a normal occlusion** of the molars and other teeth, is in reality only indicated in cases of a protrusion of the teeth of one jaw and a retrusion of the teeth of the other; the real character of which can only be determined — like all other irregularities of the teeth which affect the facial outlines — by a careful and intelligent study and comparison of the relations of the teeth to the physiognomy.

Pronounced Lower Retrusion with Slight Upper Protrusion. — In Figs. 34, 35, and 36, Chapter XIV, are shown six cases which will serve to illustrate the common facial type in one class of irregularity (Type B, Class III), which is characterized by a reciprocal disto-mesial malocclusion, and the result of correction without extraction, principally through the disto-mesial action of the intermaxillary force. The upper buccal cusps in a majority of these cases are in full mesial malinterdigitation, — the upper fully the width of a bicuspid in front of a normal occlusion with the lower, — and though the teeth have all the characteristics of the ordinary upper protrusions when viewed alone, yet it will be seen that the upper lip in its esthetic relations is but slightly protruded, and that the labio-mental depression below the lower lip is decidedly retruded in relation to chins which are sufficiently prominent. The forward curve of the lower lip is due to the fact that it rests against the incisal edges of the upper teeth; all of which plainly indicates that the lower teeth are decidedly retruded, while the upper teeth are but slightly protruded. In some of these cases the slight upper protrusion was due principally to the labial inclination of the labial teeth, which when righted did much towards correcting the overlying facial outlines. In nearly all cases of this character, and also in retrusions of the upper, where a considerable protruding movement is demanded, the crowns of the incisors will usually be forced forward to a decided labial inclination unless proper provision is made in the apparatus for also moving the roots and surrounding alveolar process. This, moreover, is particularly necessary to correct the deepened labio-mental areas which lie over the roots. The statement that the processes of growth will bring the roots forward to any appreciable extent has never been realized in the author's practice; in fact, when the roots were left with this hope, a far greater struggle arose to retain the crowns.

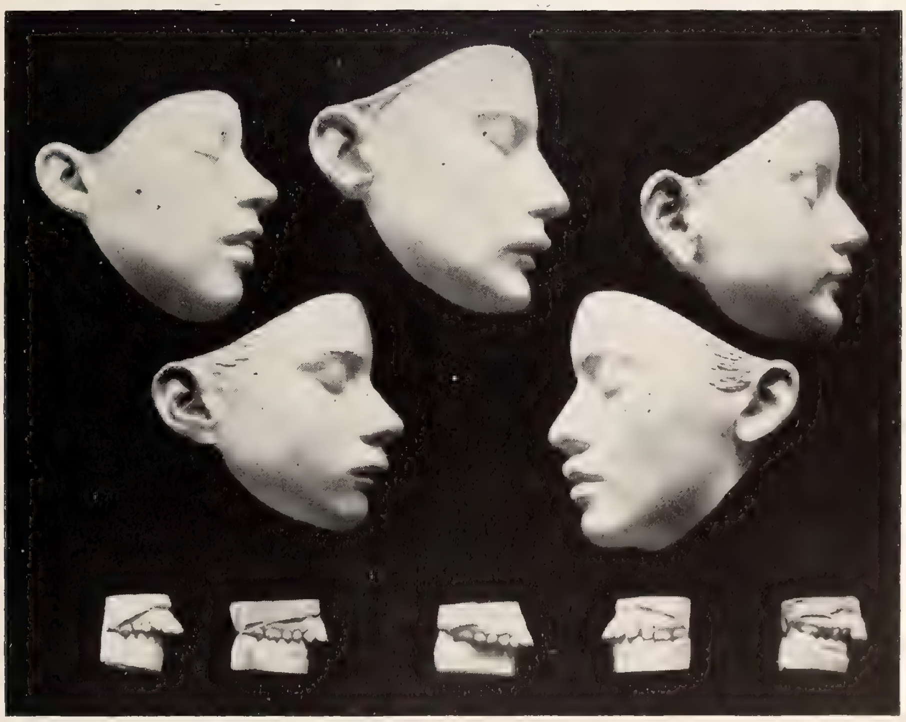
Pronounced Upper Protrusions with Slight Lower Retrusion — Another type (Type A, Class III) which is quite as common as the above with the same character of malocclusion, is where the upper teeth in their dento-facial relations are far more protruded than the lower are retruded. See Figs. 39 and 40, Chapter XIV. It does not require special skill to see that with this type a disto-mesial shifting of the upper and lower dentures to a "normal occlusion," with an unrestricted action of the intermaxillary force, would result in an abnormal protrusion of the

lower teeth in their dento-facial relations, and with only a slight correction of the upper protrusion.

As elsewhere explained (and mentioned in papers even as early as 1893, relative to the application of the intermaxillary force), the denture requiring the lesser movement should be so united and the force applied in phalanx to proportionately retard the movement according to facial — not solely occlusal — demands. And for the denture requiring the greater movement (if it is not advisable to extract) the appliances should be so constructed to accelerate or increase the relative amount of movement by applying the force to a few teeth at a time.

In a very large proportion of the last-mentioned type, where the upper protrusion is pronounced and the lower is slightly retruded, a better way is to extract the upper bicuspids; then move all the lower teeth and the upper molars forward to their normal dento-facial relations, and the upper labial teeth and first bicuspids back to close the second bicuspid spaces, which would result in a perfect interdigitating occlusion of the cusps and the correction of facial outlines; thus avoiding the complications and dangers of an extensive distal movement of the buccal teeth.

Fig. 26.



A B C D E

Variation of Types having the Same Occlusion. - If one will for a moment stop to consider the distinctly different forms of dento-facial inharmonies which may arise with the same apparent character of occlusion of the teeth, he will realize the inadequacy of occlusal relations as a diagnostic sign of real conditions, or as a competent guide to correction.

Take for instance the above common occlusion, where the lower buccal teeth are the width of a bicuspid in distal relation to the upper, one will find that there exists every gradation in facial inharmony that may be produced with this occlusion, from one extreme to the other. The extremes are: (1) cases where the upper teeth are in perfect dento-facial harmony — the malposition being due entirely to a retrusion of the lower; and (2) cases where the lower teeth are in dento-facial harmony — the malposition being due entirely to protrusion of the upper.

These constitute about five distinct types of dento-facial inharmonies (See Fig. 26), which, if all were treated according to the mathematical rule of the so-called "new school," would in the main portion of these cases result in a kind of correction that would hardly satisfy those who possess the slightest conception of the higher plane of perfection which marks the sure trend of this department of dentistry.

In Fig. 26 the dental casts are placed immediately below the profile casts to which they respectively belong. A is that of a protrusion of the crowns of the upper teeth. B is bodily protrusion of the crowns of the upper teeth. C is a protrusion of the upper teeth and retrusion of the lower. D is a protrusion of the upper dento-facial zone. E is a retrusion of the lower teeth. The above types will be found fully described with applicable treatment in Classes II and III.

Influences Which Characterize Occlusion

In mesio-distal malocclusions — a condition that obtains in a large proportion of the various classes of dento-facial irregularities — the extent of the malocclusion is commonly the width of a cusp or a bicuspid, because the forces of mastication insist upon this position whenever from local or constitutional causes the highest points of the cusps of one denture are placed, or have passed ever so slightly, beyond the crests of the normally occluding cusps of the other, from which point they are forced down the inclined planes of the occlusal facets until the cusps perfectly or fairly interdigitate.

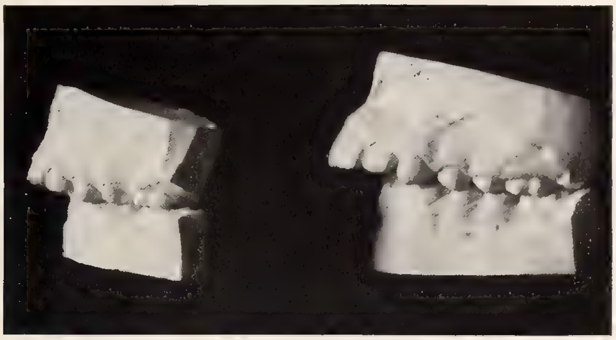
Outside of constitutional causes, the principal local cause which tends to produce a mesial malocclusion of the buccal teeth is the premature loss of deciduous teeth, followed by a mesial movement of adjoining buccal teeth, which usually results in that most frequent irregularity characterized by a maleruption of the cuspids (Class I), and far more common with the upper teeth than with the lower. If this condition is bilateral and the malalignment is corrected without extraction, and without a complete return of the buccal teeth to the positions they otherwise would have occupied, a proportionate protrusion of the teeth in front must of necessity result, providing that their originally intended positions were in esthetic dento-facial relations.

It is the rule of the human economy that the teeth naturally erupt in proper

occlusal and dento-facial relations, but as they do not always do so from causes which it frequently is not possible to determine, let us for a moment consider the influences of the force of mastication upon occluding teeth, in completing and characterizing their final malpositions.

At about six years of age the first permanent molars erupt just back of the deciduous dentures. If an inherited protrusion or retrusion of the upper or lower teeth has stamped itself upon the deciduous teeth, the permanent molar teeth

Fig. 27.



will of course assume the same abnormal relations. Fig. 27 is made from the casts of a lower retrusion at six and eleven years of age respectively.

If the malrelation is slight or not sufficient to jump a cusp, the occlusal relations will often normally adjust themselves by a reciprocal movement, though it is doubtful if they do so much before the loss of the deciduous molars and the eruption of the bicuspids, as the mesio-distal occluding facets of the molars are not sufficiently inclined to enable the masticating forces to overcome the stability of their naturally fortified positions at this time. In this reciprocal movement of molar teeth, or buccal teeth in phalanx, it should be remembered that with equal forces applied the mesial movement will be far greater than the distal, which in itself will exert its concomitant influence in characterizing the final dento-facial relations.

In those cases where the mesial malposition is sufficient to slightly jump the crests of the cusps, as in partial upper protrusions for instance, the final malinterdigitation will have been brought about by a considerable increase of the original protruded position of the upper teeth and with only a very slight — if any — retrusion of the lowers. This is true also in all cases where the molar teeth have drifted forward from local causes until they start to jump the cusps; nor do the forces of mastication commence to exert much distal movement upon the opposing teeth until their occluding facets have passed well upon the inclined planes. Therefore in all otherwise normal cases, where the upper buccal teeth have drifted forward, through the premature loss of deciduous teeth, to a sufficient extent to jump a cusp, the mesial malposition is never at any time or age

counterbalanced to more than a very slight degree by the distal movement and malposition of opposing teeth.

From constitutional causes, as before stated, the upper or lower teeth may erupt in every mesio-distal malrelation, but always subject to the culminating interdigitating forces of mastication. These forces will in most cases bring about a normal occlusion. But if they erupt with the points of the cusps slightly outside of their normal boundaries, the final result may be fully the width of a cusp from a normal occlusion.

In this connection it would be well to remember, (1) that whatever the locally caused movement, the tendency is greatest towards the mesial direction; and (2) whatever the final occlusion, the teeth of either jaw or both may be in decided malrelation to their normal dento-facial position.

False Treatment

This brings us logically to the final consideration and summing up of the treatment proposed by the "New School" of Orthodontia for all **disto-mesial malocclusions.** Practically stated, this consists — without extraction — in a reciprocal movement of the teeth of both jaws towards a common center of normal occlusion; consequently it must be considered applicable by them for all cases of **excessive protrusions** and **retrusions** of the upper or lower teeth whose occlusal relations are in malinterdigitation, or the width of a bicuspid in front of normal occlusion.

The objection to this principle of treatment is: The denture that is back of the normal occlusion may already be in normal dento-facial relation, or even slightly protruded. If these conditions are characterized by an upper protrusion for instance, with the lower in normal dento-facial relations, a reciprocal movement **must inevitably result in a protrusion of the lowers and only a partial correction of the upper protrusion.** In other words, the final result would be a composite abnormality which, if correctly defined, must be **a partial protrusion of the teeth of both jaws.**

In connection with this feature of the question, there arises a very important consideration, viz.: As before stated, with an unrestricted action of reciprocally acting intermaxillary forces, **the protruding movement is liable to be twice as great as the retruding movement.** Therefore with the intermaxillary force applied as has been commonly directed — to single molar anchorages — in these cases, the final dento-facial result is liable to be **not even one half corrected.** And yet how many young orthodontists of to-day, whose natural artistic senses are worthy of better results, are turning out cases in this condition as corrected, because they have been led to believe that the correction of irregularities consists solely in moving the teeth in some way to a normal occlusion and arch alignment. Many so pride themselves upon the belief that they have fathomed the wonderful depths

of "normal occlusion" in its relations to Orthodontia, that they crowd the journals with illustrations of their dental models to prove their successes. Dr. Cryer has said in a recent article:* "I have seen patients coming directly from orthodontists, having just such an arrangement of teeth (Fig. 10, p. 117) with 'normal occlusion' and with prognathous appearance."

Again, if it is maintained, as has been shown, that all corrections of irregularities should be accomplished without extraction, this would mean in the above cases that real dento-facial correction must consist **in a distal movement of all the upper buccal teeth fully the width of a bicuspid or more,** followed by a retruding movement of the labial teeth the same distance. If such an extensive distal movement of the crowns of the buccal teeth were possible after the full eruption of the second molars (which is not at all probable by any means), or if started early and accomplished as it may be with a heroic application of occipital and intermaxillary forces, — though not without the strong probability of producing a decided distal inclination of the buccal teeth and also the danger of impacting the unerupted molars, as Dr. Cryer has pointed out, but even admitting this to be possible, — I would still question the advisability of attempting such an extensive distal movement of molar teeth, or even one that is more than half the width of a cusp, under the most favorable circumstances.

Moreover I cannot see the advantage, from the standpoint of science, humanity, or common sense, of a considerable and very questionable distal movement of molar teeth that are in natural positions in the jaw, or in other words that have not moved forward to unnatural positions from local causes; unless the operation contemplates the ultimate extraction of the third molars, which are often quite as important in the dental economy, especially when uncrowded in development, as the first or second bicuspids, particularly when the loss of the latter teeth in appearance and effect is hardly discernible.

This would mean also that one would need to keep in touch with these cases — which is usually impossible — and be ready to extract the third molars at the very beginning of their eruption; else you may be sure that the influences of these teeth upon a crowded dental arch that is artificially posed and therefore predisposed to a protruding movement, and with its bases encroaching upon the room which the third molars require for eruption, will destroy all efforts of correction even though opposed by the forces of a typically normal occlusion.

*Cryer.— Dental Cosmos, Feb., 1905.

CHAPTER XIII

THE IMPORTANCE OF PRESERVING DECIDUOUS AND PERMANENT TEETH

The title of this chapter refers to a phase of dentistry in which the errors in judgment are so frequent and serious that it would seem there is a thoughtless disregard of principles which Nature has evidently considered of the greatest importance in the development of a wonderful system of dentition which no thinking mind can contemplate without amazement and admiration. It relates to the baneful influences and results which naturally follow the injudicious and unnecessary extraction of deciduous and permanent teeth. It is a subject which reaches into so many phases of dental and dento-facial irregularities, that it will be impossible in a single chapter to do more than mention some of its main principles, leaving the reader to follow out the details found in many portions of this work.

In regard to the importance of preserving the deciduous teeth, it would seem that enough has been said, enough is being taught in our colleges by competent teachers, to prevent the errors in after practice that so frequently confront us. Of those who have not received these advantages, it would seem that long experience in the practice of dentistry, confined as it is to so small an area of the human body, would prevent the possibility of that which at times appears to be a ruthless interference with one of Nature's most important provisions.

The deciduous teeth are most evidently for the purpose of affording means of mastication during the years when full-sized permanent teeth would be all out of proportion in size and appearance to the small jaws and features. They are there for the purpose of holding the fort, as it were, so as to give Nature an opportunity to perform one of the most beautiful of her acts in developing and bringing forward the permanent teeth in successive and systematic stages, timed in proportion to needs and growth. They are there, moreover, for the purpose of establishing occlusal relations of the permanent teeth and harmonious relations of facial outlines.

At about five years of age the first permanent molars commence to crowd their way into the arches between the bases of the deciduous arches on one side, and the rami and tuberosities on the other. Nature, apparently conscious of the forceful influences of this eruptive process towards an interstitial forward movement of the entire deciduous dentures, has provided the deciduous molars with broad spreading roots so as to take a sufficiently firm and immovable hold of their surroundings to successfully combat this force, in the same way that will be found with the roots of trees which are subjected to the force of strong winds. Note also how perfectly Nature under normal conditions has timed this eruptive

stage to prevent that possibility which she so evidently fortifies herself against; and at the same time to take advantage of the general developing forces of eruption. She starts this stage of secondary dentition at a time when the strong phalanx of the deciduous denture is there, or should be there, to resist the forward pressure of these erupting molars; nor does she commence it before there is nearly enough room by growth for those large teeth; nor before the alveolar surroundings of the deciduous roots are developed to comparative stability; nor does she wait until those roots have become weakened by resorption from the eruptive forces of the bicuspids.

What could be more prophetic than these painstaking acts on the part of Nature, in emphasizing the importance of preserving the natural relative position of the bases of the deciduous arches, in order that the permanent molars which are destined to establish the occlusal relations of the adjoining permanent buccal teeth will not be allowed to drift forward of their natural positions; since it is upon the established position of the first permanent molars that the relative positions of adjoining buccal teeth are regulated, which in turn finally establish the occlusion and dento-facial relation of all the teeth. From this we may draw a lesson of the importance of preserving these temporary piers to the future arches until the time of the eruption of their successors, because at whatever stage the arch is long deprived of their support, the permanent molars will surely tend to drift forward to fill the gaps, notwithstanding the restraining influences of perfect interdigitating occluding cusps.

I wish to call attention to another of Nature's acts along this line which is prophetic of the apparently recognized tendency of the permanent molars to drift forward, and of the importance of preventing it up to the last moment. In the typically normal processes of secondary dentition, when the second deciduous molars are thrown off, the second bicuspids are ready to prick through the overlying gum tissue, and soon take their places in preserving the integrity of the arch. This is another reason for the spreading of those deciduous roots, that the resorptive forces of eruption may have an opportunity, without the necessity of extraction, to make a place beneath for the bicuspid crowns, and thus permit them to erupt as much as possible up to the last moment of their power to hold the required space open. Otherwise, as is frequently seen, the lower second bicuspids are impacted in the dovetailing inclination of adjoining teeth, because of the premature extraction of the second deciduous molars. It may be that this is one reason why the second bicuspids are the only ones of the permanent dentures which occupy less space than the deciduous teeth that precede them, in order, perhaps, that they may have a little better chance to get into place before the adjoining teeth can shut them out.

Thus, I might take up one stage of dentition after the other and show how Nature's ways are prophetic of the importance of avoiding the premature extraction of the deciduous teeth. There are a number of allied branches of this sub-

ject also which space will not permit me to touch, viz.: The natural influences exerted by dentition; by occlusion; by the action of the buccal and labial muscles; by the growth and development of the jaws, especially that of the mandible, which Dr. Cryer has pointed out; all of which tend to characterize and establish the utility and harmony of the teeth in their relations to use and beauty, and which may be greatly interfered with by the premature loss even of deciduous teeth.

Irregularities from Premature Loss of Deciduous Teeth

I cannot leave this phase of my subject without trying to emphasize its greatest lesson, which cannot be too often repeated. It will be seen that the principal condition referred to relates to that large majority of people whose permanent teeth are, or would have been **normal in occlusion** and **dento-facial relations** in all instances, had the deciduous teeth been preserved, or retained, according to Nature's requirements. With these naturally normal conditions, if the loss of deciduous teeth has permitted the permanent buccal teeth to drift forward, ever so slightly, from an otherwise normal dento-facial position in the arch, and the front teeth then erupt in alignment, *an abnormal protrusion of the facial outlines will be produced exactly in proportion to this movement.* This shows how from premature extraction, or unnecessary loss of deciduous teeth alone, protrusions of the permanent teeth may arise which, though in amount but slightly change the facial contours, are sufficient to mar the expression of an entire physiognomy. When this occurs with both upper and lower dentures, as at times it no doubt does,—all of the teeth having been forced forward of their normal position, and with a possible preservation of normal occlusion and alignment,—it is a most unfortunate affair, because people in general, and among them dentists of renowned ability in Orthodontia, seeing these perfect conditions of **normal occlusion,** interpret the facial imperfections which have resulted from this local cause as inherent, or as perfect as it is possible for that individual. They hardly imagine in the faces constantly met, that there has occurred an unnatural and unnecessary abnormal protrusion to a more or less extent over the entire dento-facial area, characterizing the features, producing unesthetic expressions, and marring those perfect outlines which Nature would have produced had she been permitted or aided in having her way.

Consider another phase: If this unnatural drifting forward of the permanent buccal teeth occurs — as it commonly does — before the eruption of the cuspids, which may have been partly or wholly caused by the premature extraction of the deciduous cuspids in a foolish attempt to prevent a malposition of the incisors, the irregularity which is characterized by a maleruption of the cuspids is frequently produced. This irregularity, more common with the upper than the lower cuspids, is the most frequent of any of the extensive malpositions which the orthodontist is called upon to treat. And in this fact alone, and because it most

frequently arises from the injudicious and unnecessary extraction of deciduous teeth, it stands, in this stage of our professional progress, as a sad commentary upon the appreciation of those higher principles which Nature has emphasized and which plainly show the importance of preserving the deciduous teeth.

Irregularities from Injudicious Extraction of Permanent Teeth

It is with the above irregularity — crowded maleruption of the cuspids — that dentists most often err in an injudicious extraction of permanent teeth. In addition to the many instances of this character where the bicuspids are wrongfully extracted for the purpose of regulating teeth by artificial force, there are a far greater number of cases, where dentists have extracted the bicuspids or the lateral incisors, and even the malerupting cuspids, in an honest endeavor to aid Nature in correcting an irregularity which to them seemed otherwise impossible. The case may also have been one which they had caused by an injudicious extraction of deciduous teeth or a careless failure to preserve the deciduous molars up to the last moment of their usefulness.

Some years ago a prominent Chicago dentist called at my office and asked, "Doctor, when you have cuspids that are erupting through the gums above, and with little or no spaces between the laterals and first bicuspids, you have to extract teeth to get them into the arch, don't you?"

I showed him many plaster casts proving that however irregular the teeth, however bunched, malaligned, or malposed, they could always be placed in their respective places in the arches and in normal occlusion, and therefore, so far as the relations of the teeth to each other are concerned, **no dental malposition should be taken as a basis for extraction.** The only excuse then for the extraction of "saveable" teeth must be that it is inexpedient or impossible to correct their positions in that way without producing a facial protrusion. In nearly all locally caused malpositions of the teeth in immature arches, the final development of the jaws and general growth-enlargement of the features demand all of the teeth and their sustaining alveolar arches to harmonize facial relations. To remove one or more of them under these conditions will inevitably produce its effect. The effect upon normal arches that would be otherwise harmonious in size and relations, is invariably an abnormal contraction of the arch so affected, and the ultimate forcing of the teeth of the opposing arch into malalignment and malocclusion which frequently results in a facial deformity.

When these truths dawned on his mind, he said: "Doctor, I believe I have made a very grave mistake. I feel badly about it, principally because it has happened in a family who are my nearest neighbors and dearest friends. Wishing to do the very best for their little girl whose upper cuspids were erupting in this way, I extracted the first bicuspids, and now at about 15 years of age I find that all of the upper front teeth are biting back of the lower ones, with quite

a depression of the upper lip, which gives her the appearance of a protruding lower jaw."

Suffice to say, the case was corrected as shown in Fig. 28, by a bodily pro-

FIG. 28.

truding movement of the upper labial teeth, preparatory to inserting artificial bicuspids to sustain the arch.*

This branch of the subject is continued in the next chapter in connection with the phase which relates to the judicious extraction of permanent teeth from protruded arches. It will be found to give conclusive proof of the statement previously made, that in the practice of dental orthopedia it is quite as much malpractice to not extract teeth when demanded, as to extract teeth when not demanded.

* I regret to record that this case drifted from my care before I had an opportunity to properly retain the teeth and insure the position with artificial bicuspids, with the result that some years afterwards, the front teeth were found to be assuming their former malpositions.

CHAPTER XIV

THE QUESTION OF EXTRACTION IN DENTAL ORTHOPEDIA

The question of extracting permanent bicuspids as an aid or necessity to the most successful correction of dento-facial protrusions is of such vital importance that the author has decided to republish in this chapter a revision of a somewhat controversial paper which appeared under the above title from his pen in the Dental Cosmos, for April and May, 1906. Moreover, as the theory that "no teeth should ever be extracted in the correction of irregularities" has been widely promulgated, and quite extensively accepted, as one of the basic principles of the so-called "New School" of Orthodontia, the author deems it but just to place before students the character of evidence which the leading men of that school present to establish the theory, as compared to that which he believes is more in accord with correct principles of applied science and art.

This chapter deals extensively with the most important principles of the subject from the practical standpoint of long experience. In it will be found many thoughts reclothed that appear in other parts of the work, but which will bear repeating from every phase of their application, because of their importance, and the difficulty with many to grasp ideas, however true, which are dependent upon a variety of conditions.

The Symposium on the Extraction of Teeth

At the February, 1905, meeting of the Second District Dental Society of the State of New York (the proceedings of which were published in the Items of Interest for August, 1905), certain prominent orthodontists of America were invited to present contributions relative to the advisability of extracting teeth as an aid or necessity in the correction of irregularities.

It is not the purpose of this chapter to attempt a lengthy discussion of the papers in general, which, with the beautiful illustrations, formed in the main a most worthy and commendable series of contributions to the science of Orthodontia; and, barring some statements which had no foundation as matters of scientific fact, and certain propositions which claimed to be proved by the illustrations, but which would fall far short of it in the light of an equally fair showing of the other side, I am pleased to say that I heartily agree with most of the sentiments expressed by the non-extractionists which related to the cases they presented as evidence to substantiate their theory, and am especially pleased that the advocates of non-extraction presented so forcible an argument.

I hope that the truths of these papers will sink deep into the hearts and practice of that horde of dentists who — though perhaps with honest purpose but with dense ignorance of the subject — are indulging in the indiscriminate, thoughtless, and disgraceful malpractice of extracting deciduous and permanent teeth for the correction or prevention of complex irregularities — reprehensible in all cases, however crowded or jumbled the arch, where the dento-facial relations of the teeth **do not positively indicate a decided protrusion.**

In this connection it would be well to remember, as pointed out in other chapters, that the true position of the teeth in relation to dento-facial harmony can never be determined by dental relations, or the relations which the upper and lower teeth bear to each other, as one would be inclined to infer by the almost total absence in the said papers of any reference to this important principle in orthopedic dentistry.

Another peculiarity of the contributions from the non-extractionists was that the principal, and in most cases the only evident object, was to show the possibilities of producing a **normal occlusion** for symmetrical, dental, and functional purposes alone. However, in that large majority of the cases where the facial outlines were neither shown nor mentioned, and also in the most of those which were shown to be improved, it is to be presumed — and I have no desire to deny — that they were exactly the cases that should be corrected without extraction.

A very large proportion of the contributions from the non-extractionists consisted in showing the baneful results from injudicious extraction of teeth. These mistakes are frequently made by uninformed dentists, and by some of the best of us. Besides the thousands of disasters that have been produced in occlusal relations by the needless and in some instances criminal extractions of permanent teeth, there are numberless dento-facial imperfections and deformities which have arisen solely from this same cause. I have at times been quite surprised at the poor judgment shown by dentists, even of advanced standing, in extracting deciduous and permanent teeth, and when one considers the hundreds of dentists of less ability let loose upon trusting communities, it is not strange that there arise so many examples of criminal malpractice along this line, especially in the extraction of perfect permanent teeth from crowded arches in which all of the teeth are necessary to perfect occlusion and dento-facial relations. Many seem to be wholly ignorant of the quality, possibilities of movement, and function of the alveolar process, which is susceptible of any required degree of arch enlargement to accommodate the teeth, however crowded and malaligned.

Fig. 29 is made from the casts of a case sent to me from Ohio for correction. In the letter of introduction from the dentist, he referred to the case, saying, "I have extracted the first bicuspids, knowing that you would find it necessary." The casts speak for themselves. It would seem that any novice would know better than to extract teeth from an arch so plainly seen to be retruded.

Nor is injudicious extraction for correction of irregularities confined to the

bicuspids. Next in order of frequency of extraction are the cuspids, lateral incisors, and the first permanent molars. In one case presented at my clinic the central incisors had been extracted for this purpose.

In Class IV, will be found illustrations and descriptions of three cases of retruded upper teeth, with quite marked facial deformities, all of which had been caused by the injudicious extraction of teeth from the upper arch.

Fig. 29.

But does this prove that extraction should never be resorted to under any conditions? In other words "that extraction is wrong, that the full complement of teeth is necessary to the best results" even in cases of decided upper protrusions? Most certainly not. On the contrary, it simply proves that the accidental or unavoidable loss of certain teeth and the injudicious extraction of teeth — mostly by incompetents — has resulted in certain cases in disaster to normal occlusion and regularity. Absolutely nothing more. The collection and portrayal of disasters in railroad travel, and in the use of anesthetics, would be quite as legitimate to prove that humanity should desist from the employment of those benefits, as that such evidence should be presented in order to prove that extraction is never demanded in the correction of dento-facial irregularities.

In this connection I wish to say that there are doubtless many cases,— for example, of decided upper protrusions, — which have been properly and perfectly corrected by extracting the first bicuspids, but which, not being retained a sufficient length of time, the reactive forces — possibly of inheritance — moved the teeth more or less back toward their former malpositions. In many of these cases the patients are to blame for failing to report at once the first apparent

tendency toward the reactive movement. I presume this applies to a number of my cases. But what would it prove? Nothing further than that the teeth after correction were not retained a sufficient length of time. If the reactive forces were sufficient to carry the front teeth forward again, which alone had been retruded to fill the spaces of extracted first bicuspids, would not that tendency be greatly increased with **all** of the upper teeth crowded back the width of a bicuspid, or even to only one half this degree?

It has been frequently asserted or implied that a normal occlusion is the only occlusion which will tend to retain the teeth in corrected position. This is not true, because the advantage of interdigitation of the buccal cusps to retain teeth in abnormal position and also in corrected positions when the first bicuspids have been extracted, is quite as effective. So that this theory cannot be used as an argument for non-extraction. In fact it will be found that an extensive disto-mesial shifting of the teeth with the intermaxillary force, now widely practiced by the non-extractionists for obtaining a normal occlusion in all disto-mesial mal-occlusions, is far more liable to result in non-retention, than are those cases where bicuspids have been extracted and the original occlusion of the back teeth has not been disturbed, or but slightly changed, to correct lateral relations and the interdigitation of cusps. Therefore it will not surprise me to find in a few years that the majority of the present most enthusiastic advocates of the intermaxillary force are its bitterest enemies, simply because they are overdoing a good thing.

EXAMINATION OF THE EVIDENCE PRESENTED

Out of the entire **forty-five cases** that were exhibited by the non-extractionists at the said meeting, there were only **seventeen cases** presented to show the beneficial results of correction without extraction. Nearly all of the balance consisted of illustrations of cases which had been collected by the non-extractionists all over the country, to show bad results that were due to the extraction of teeth. Now please note the character of the **seventeen cases** which they presented to prove that all irregularities should be corrected without extraction. Of these, **eleven cases** consisted of that irregularity which is characterized by a labial maleruption of the upper cuspids.

Maleruption of the Cuspids

I have noticed for some time in the various published papers and articles which were written ostensibly for the purpose of proving the benefits of regulating without extraction that the principal, and in some instances, almost the only irregularity presented as evidence was that which is characterized by the maleruption of the upper cuspids.

This particular feature of the display may serve as one of the very best modes of disciplining a large proportion of dentists who essay the regulation of teeth,

because there has been no character of irregularity in which the errors of injudicious extraction of the bicuspids and other teeth, as an aid to correction, has been so frequent, so grave, and so uncalled-for. But to the mind of an experienced orthodontist, the possibilities and demands for correcting these cases without extraction give no evidence in favor of the universal practice of non-extraction, because it happens to be a fact, and one that should be well known, that in about nine out of every ten cases of this particular character of irregularity, extraction of the bicuspids is absolutely culpable. Why? Because in about this proportion of these cases the teeth, which otherwise would have been in normal dento-facial relations and occlusion, have assumed that unnatural malposition from local causes. Usually the premature loss or injudicious extraction of deciduous teeth have permitted natural forces to push the buccal teeth forward, and the incisors back, to a partial or complete closure of the permanent cuspid spaces, and often with a concomitant contraction and malalignment of the lower arch.

I could have shown from my private practice a far greater number of these cases than were exhibited at the meeting, some of which would have indicated to a novice even greater need of extraction from a dental point of view, but all of which were perfectly corrected without extraction. In fact, had extraction been resorted to, in most of the cases irreparable wrong would have been done to the patient.

Fig. 30.

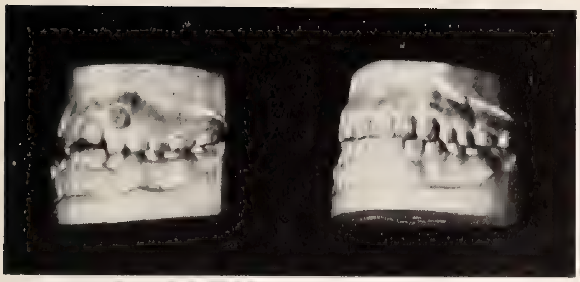


Fig. 31.

Fig. 30 is a fair sample of many cases. It will be seen upon the left side that the space for the cuspid was completely closed, and notwithstanding the very crowded condition of the dental arch it was evident at the start, from the un-

developed facial area, that the adult physiognomy would require all of the teeth in the arches for the development of perfect dento-facial outlines and beauty.

This is well shown in Fig. 31, which was made from a photograph of this patient taken after treatment. One who would be foolish enough to mar the beauty of such a face by extracting teeth to aid in the operation for correction would not deserve the title of orthodontist.

Does this prove, however, as has been claimed in various places by this kind of showing, that extraction should never be resorted to in any case of maleruption of the cuspids? It does not. It simply proves nothing toward establishing a universal law of non-extraction, nor do the occlusal relations or their malalignments indicate in the slightest degree whether teeth should be extracted or not; because I can show another lot of dental casts representing cases in practice in which the relations of the teeth are exactly the same as the above, except that the mesial malrelation of the upper buccal teeth to the lower are more pronounced; and for which, had I *not* extracted the upper first or second bicuspids, the inevitable result would have been a facial deformity. Why? Because the natural or inherited dento-facial relations of the upper buccal teeth which were in mesial malinterdigitation with the lowers, plainly indicated that they were fully the width of a bicuspid in front of the position they should occupy in order that the labial teeth when in alignment might be in dento-facial harmony.

Fig. 32.

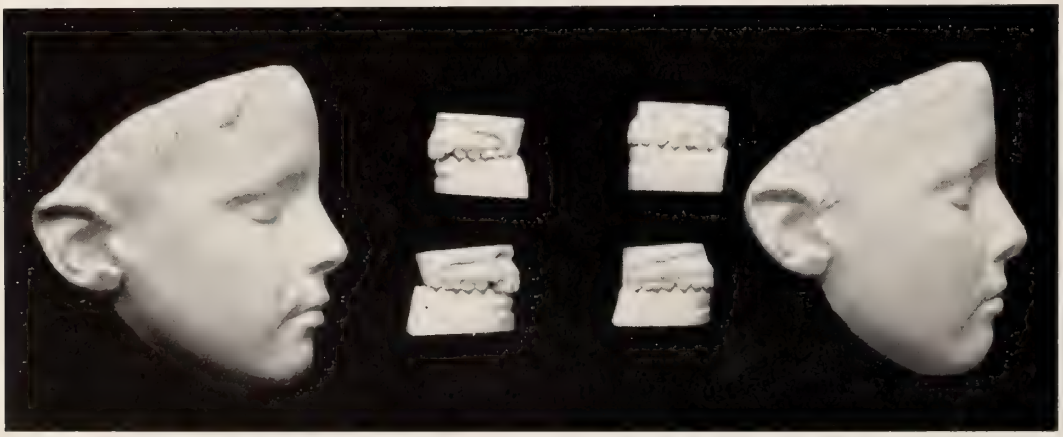


Fig. 32 will serve to illustrate the character of these physiognomies. The protrusion of the upper lip immediately over the malaligned cuspids is usually quite marked, and would have extended in this case to the entire upper lip, with the production of an upper protrusion, had the teeth erupted in alignment.

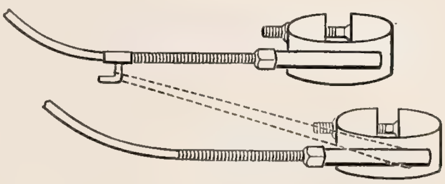
Many of the non-extractionists will say: Why not push the upper buccal teeth back one-half the width of a cusp, and the lower forward the same distance, and thus avoid extraction and establish normal occlusion? In a not far distant future this foolish question will not be asked so frequently or so loudly as it is to-day.

Many of these cases would have resulted in the common upper protrusions, like other inherited cases of this character, had it not been for the possible premature loss of the deciduous teeth, which permitted the labial muscles to press the incisors back to close the cuspid spaces. The buccal teeth also may have been forced slightly forward to a complete malinterdigitation. Be that as it may, without extraction an upper protrusion would have been inevitable. In Fig. 32, as is common with this type, the lower teeth at the beginning were in perfect dento-facial relations. That is, the lower lip supported by the lower labial teeth and alveolar process was in perfect esthetic position in relation to the chin, while the lower jaw and chin were strong and in perfect esthetic relation to the principal features of the physiognomy. In these cases, as in many others of the same character, the upper buccal teeth in natural occlusion are occasionally fully the width of a cusp in front of a normal occlusion, as can be seen. Now let us suppose that these cases had been corrected without extracting the first bicuspids. Can anyone who possesses the slightest conception of the fitness of things say that in the correction of occlusion in this way the dento-facial outlines do not demand that the movement should be confined to the upper teeth alone, and should consist mainly in a distal movement of the buccal teeth fully the width of a bicuspid? And further, had such an extensive distal movement of the buccal teeth been possible — which is very doubtful after the eruption of the second molars — would it have been possible, in the process of tipping the crowns of all of those eight teeth backward the width of a bicuspid, with the inevitable dipping of their occlusal planes, to have produced in this way the same perfect interdigitating, masticating occlusion, which Nature had already produced through the forces of inheritance, development, and use?

And would it have been possible to retain that position with the natural reactive forces and the final eruption of the third molars driving them forward? If such an unnatural position of the teeth in the jaws could be maintained by any means, would not such a plan be very liable to impact the third molars?

Methinks I can hear the non-extractionists all cry out as with one voice, "Oh, no! We would not think of doing it that way at all!" Nor would they. What they would really do under these circumstances in their present state of mind — believing as they do in the universal law and applicability of normal occlusion in

Fig. 33.



every case — would be to apply the intermaxillary force through the medium of an apparatus similar to that shown in Fig. 33. With this they would doubtless produce a normal disto-mesial relation of the cusps of the upper and lower buccal

teeth, and then when the upper cuspids and incisors were placed in arch alignment on the basis that all the other teeth were corrected, they perhaps would take plaster impressions of the case and construct beautiful casts, the pictures of which they would present on screens and in journals, thus demonstrating the wonderful results and possibilities of correcting these cases without extracting; and their audiences and readers, viewing only the pictures of the teeth, would perhaps be convinced that it was the only scientific way to regulate teeth.

Now let us see what they really would have accomplished from the standpoint of that higher plane of orthopedic dentistry, which some day is sure to hold sway in this department. The crowns of all the lower teeth would have been moved forward with the production of an unesthetic protrusion of the lower lip, and the upper buccal teeth would have been moved back to a position which permitted only a partial dento-facial correction of the upper labial teeth. Furthermore, if they had employed the apparatus shown in Fig. 33 (and I want to say that this is the only apparatus with its reverse action which has as yet been published by the "new school" for the application of the intermaxillary force), the protruding movement of the lower teeth would have been about twice as great as the retruding movement of the upper, as I have repeatedly pointed out, and which I am glad to say has also been fully confirmed by Dr. Ottolengui, a former president of the American Society of Orthodontists. This is also confirmed by Dr. Angle on page 256 of "Malocclusion of the Teeth and Fractures of the Maxilla." ("Sixth edition.")

The facial result of this method of operating in these cases, therefore, would have left the patient with a decided protrusion over the entire dento-facial area, and which finally impales the theory of non-extraction, in cases of this type, upon either horn of the dilemma.

This argument applies not only to all of this particular type of irregularity (which is Type C of Class I, in my classification), but it applies to all decided protrusions of the upper teeth with the lower normal, which is Class II.

Bimaxillary Protrusions.—Occasionally in a bimaxillary maleruption of the cuspids with the buccal teeth in normal occlusion, the facial outlines plainly indicate that a decided bimaxillary protrusion would result in any attempt to correct the irregularity without extraction? This is pointed out in Chapter XII, and illustrated by Fig. 23, p. 134.

As shown by the finished profile in that case, the protrusion was not wholly reduced even after the extraction of all the first bicuspids, and with every possible effort made to reduce it by the employment of occipital and intermaxillary auxiliaries.

Simple Malpositions

Of the remaining six cases of the Symposium which were exhibited to prove that teeth should never be extracted in the practice of Orthodontia, two cases

were youths with buccal occlusion normal, but with crowded malalignment of the labial teeth, due to premature loss of deciduous teeth; a character of irregularity for which extraction is never indicated, except in those rare cases where bimaxillary protrusion is strongly in evidence.

Retrusion of Upper

There was one case of a decided retrusion of the upper teeth with a slight protrusion of the lower, for which condition no one but a novice would think of extracting for correction.

There are, however, extreme cases of this class in which the protrusion of the lower teeth in relation to the chin and main features of the physiognomy is far more pronounced than the upper retrusion, and which demand the extraction of lower teeth. This is well shown in Fig. 45, p. 347, which represents a case now under treatment for a patient twenty-four years of age, with all the teeth erupted and the lower arch crowded and overlapping. I should like to ask if the advocates of non-extraction would undertake the futile attempt to retrude all of those sixteen lower teeth the distance demanded for a correction of the lower facial outlines?

Mesial Malocclusion of the Upper in Relation to the Lower

Finally, to complete the number of corrected cases shown at the Symposium, there were only three cases which exhibited a decided mesial malrelation of the upper buccal teeth to the lower, and with the relations of the front teeth in that malposition which is commonly, though often quite erroneously, characterized as "upper protrusions." This character of malocclusion constitutes Dr. Angle's Class II. It is placed in my classification as types of Classes II and III.

These three cases were the only ones presented by the non-extractionists, so far as I have a right to judge, about which there should ever have arisen a question of extraction. It may well be asked: Can it be true that out of forty-five cases presented by the non-extractionists at a symposium which was especially organized to foist their claims, there were only three corrected cases presented by them about which there could ever arise in the minds of competent orthodontists a question of extraction? The published record speaks for itself.

Now let us somewhat extensively consider this particular character of malocclusion in its various dento-facial relations, and its correction without and with extraction of bicuspids.

I am going to assume that the said three cases were perfectly corrected without extraction, and that the best possible dento-facial results were obtained. It goes without saying also, that the correction was accomplished principally through the reciprocal disto-mesial action of the intermaxillary force, which moved all of the lower teeth forward and the upper teeth backward, until the occlusion of the

buccal teeth was normal. We must all, therefore, admit at the start that these cases, dento-facially considered, were originally protrusions of the upper in connection with retrusions of the lower, else such a movement of the teeth would produce abnormal or unesthetic facial outlines. I hardly think it would be asserted that any one of these cases was purely a protrusion of the upper, which would mean that the lower teeth being in proper relation to facial outlines should not be moved forward, else there would be an abnormal protrusion of the entire lower lip, with a partial or complete obliteration of the esthetic labio-mental curve beneath the lip so necessary to perfect facial contour, and with the possible production of that least to be desired of all expressions, a receding chin. It would also mean that proper dento-facial and occlusal correction was accomplished by moving all of the upper teeth back fully the width of a bicuspid in those cases that were in full malinterdigitation, else the upper protrusion of the facial outlines would not be fully corrected. The objections and doubtful possibilities of this extent of movement, especially after the eruption of the second molars, have been mentioned under another head.

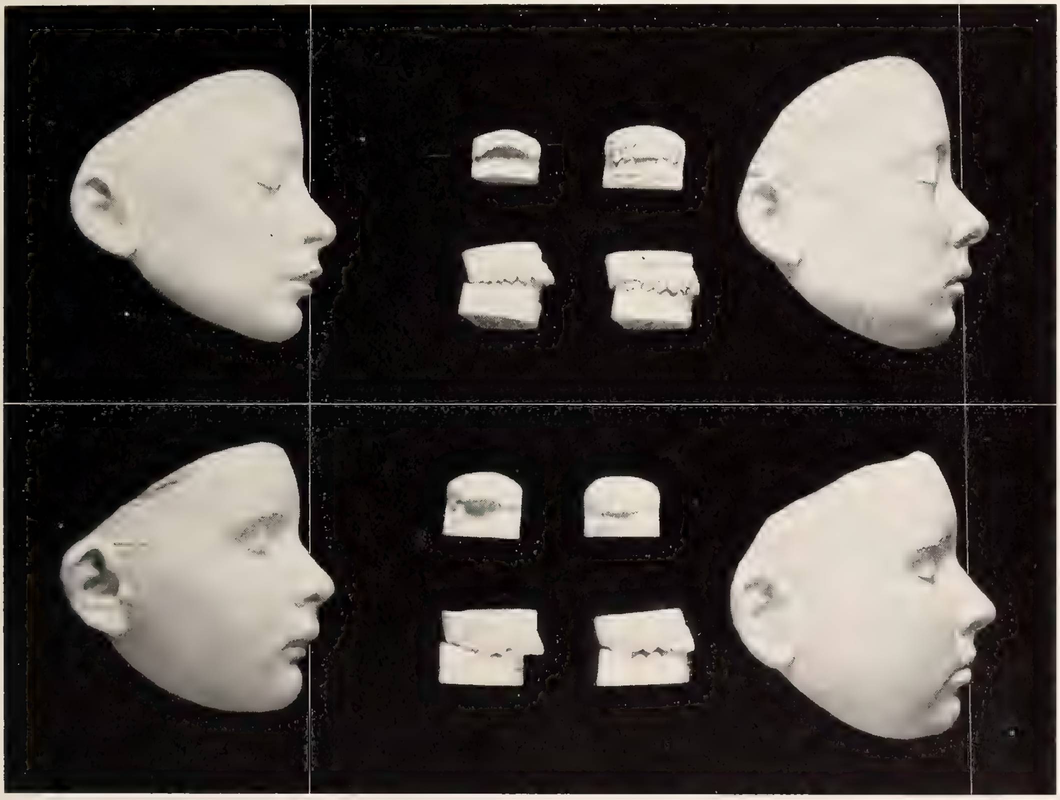
On the other hand, does it not also go without saying, that these cases were corrected with the Angle appliances? And if there are no other of his appliances for employing the intermaxillary force that are radically different from that shown in Fig. 33, would it not be well to admit that all of these cases were more of a retrusion of the lower than protrusion of the upper? Because with an uncontrolled reciprocal action of the intermaxillary elastics which that apparatus implies, the lower teeth would be moved forward considerably more than the upper teeth would be moved backward, and if such a movement is not demanded for the perfection of facial outlines, it would be wrong, except in the eyes of those who can see no wrong when normal occlusion can somehow be attained.

A decided protruding movement of all the lower teeth, and a slight retruding movement of the upper, is frequently demanded in cases in which the upper teeth in relation to the lower are fully the width of a cusp in front of a normal occlusion. There are also an equal number of cases in which an equally reciprocal disto-mesial movement is demanded. In fact, there is demanded for the correction and perfection of dento-facial outlines, with this particular malocclusion, every gradation of movement which lies between retrusions of the lower teeth with upper normal, and protrusions of the upper teeth with lower normal, a very large proportion of which can be, and for many years have been corrected without extraction, principally by an intelligent application of the intermaxillary force; not only by myself, but I presume by other orthodontists who commenced the employment of this force soon after its first publication in 1893. Dr. A. E. Matteson writes me that he used this force for the disto-mesial adjustment of occlusion quite extensively as early as 1894. At that time he was professor of Orthodontia in the Northwestern University Dental School. The next year, Dr. Angle occupied the chair of Orthodontia in that school, with Dr. McDowell as his assistant. The

latter has assured me that a number of Dr. Matteson's clinical patients who came to continue their work under the new régime, were wearing the intermaxillary elastics from the upper to the lower teeth, and that he was required to replace these appliances with Dr. Angle's, who did not employ or recognize the disto-mesial intermaxillary force at that time, nor until about five years later.

Had I been present to participate in the New York Symposium, it would have been possible for me to have presented many cases in which the upper teeth in relation to the lower were in the same disto-mesial malocclusion as the said three cases exhibited, and for all of which real dento-facial correction was perfectly accomplished without extraction.

Fig. 34.



Retrusion of Lower, with Slight Protrusion of Upper. — Figs. 34, 35, and 36 are presented to show six cases of Type B, Class III, or that irregularity which is characterized facially by a decided retrusion of the lower teeth with a slight protrusion of the upper. Note the original decided antero-posterior malrelation of the upper and lower teeth in masticating occlusion.

The patient represented by the last one of the group, with many others of a different character, was personally examined by Dr. R. Ottolengui, who, I think, will vouch for the correctness of the illustrations. Compare the facial results of any one of these six cases with those of the said three cases exhibited at the Symposium.

Fig. 35.

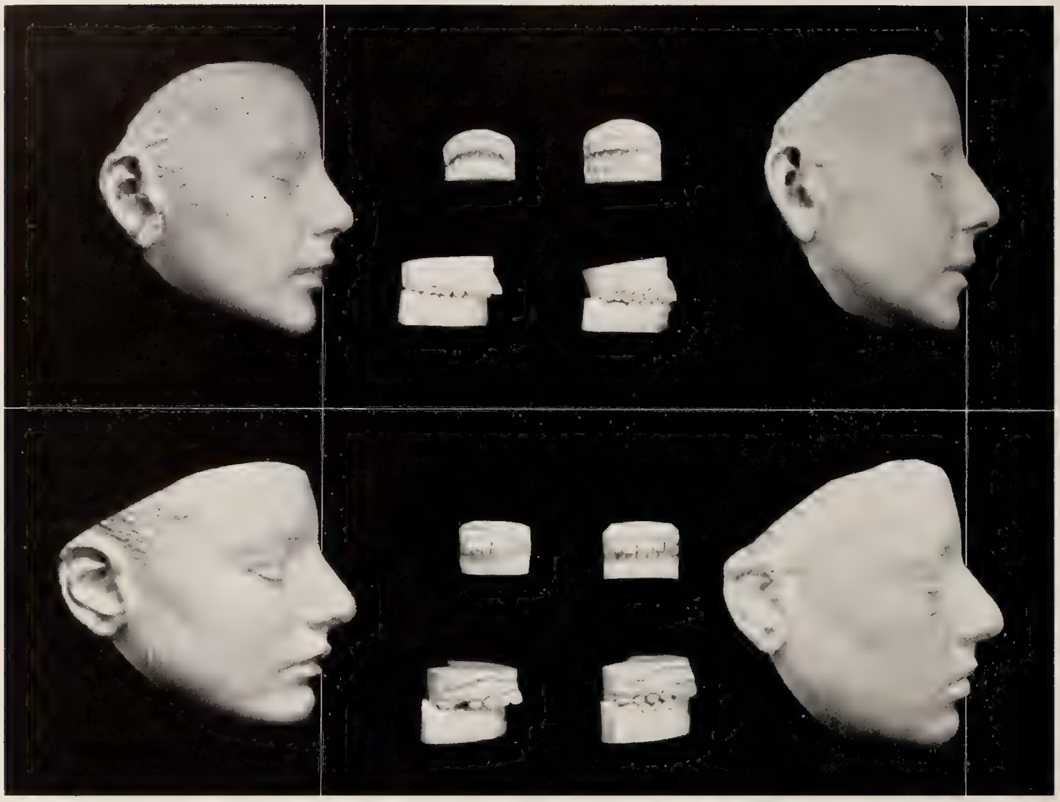
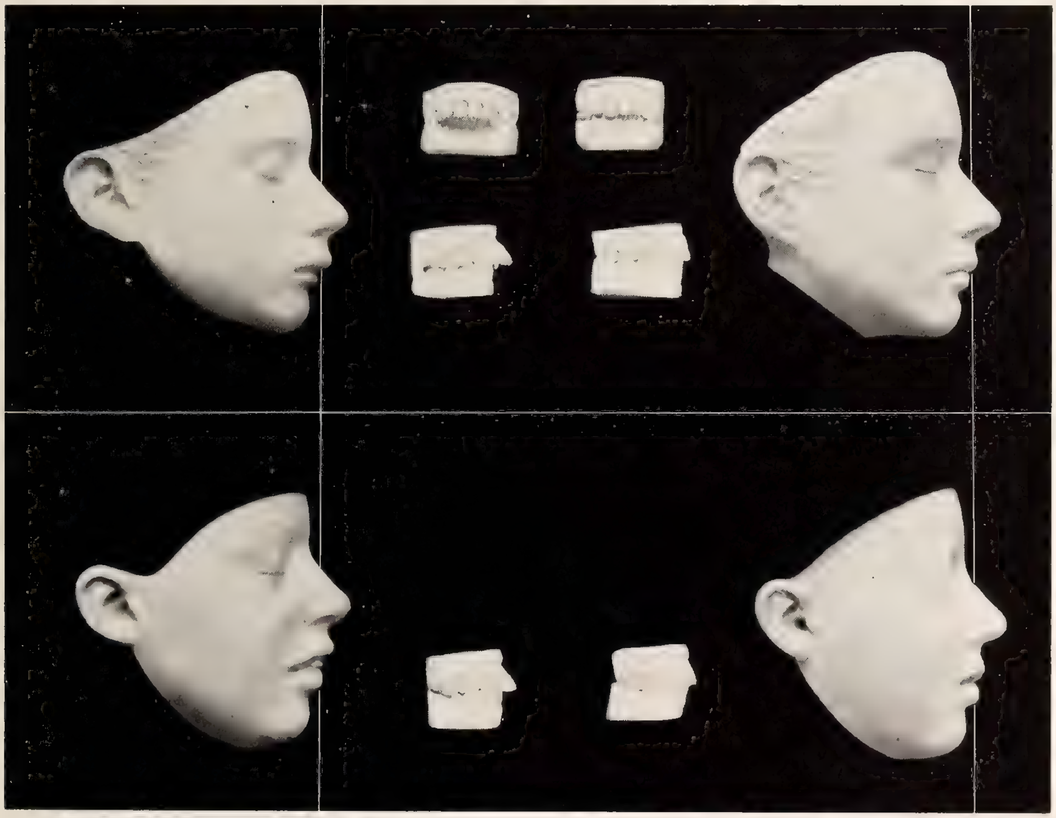


Fig. 36.

Would I not have, at least, an equal right to assert upon this showing that extraction is never indicated? Then, why is it not true? Because there are other types having exactly the same antero-posterior malrelation of the upper and lower teeth, many of which cannot be **dento-facially** corrected without extraction; and others which involve a possible but too extensive distal movement of buccal teeth should not be corrected without extraction.

Protrusions of Upper with Lower Normal.—I shall first call your attention to types of Class II, which are characterized by decided upper protrusions with the lower normal, and which demand, from an esthetic standpoint, that the entire movement calculated to properly correct the facial outlines can only be accom-

Fig. 37.

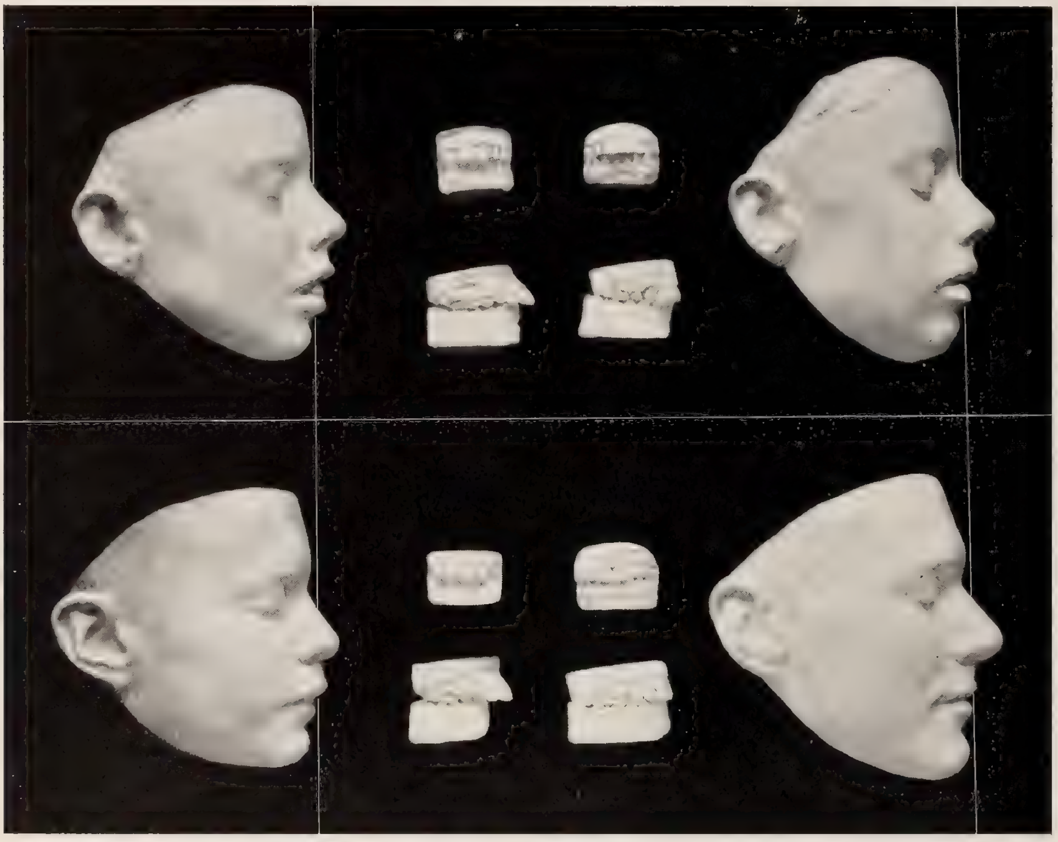


plished by a retruding movement of the upper labial teeth and alveolar process, a movement which usually can be easily accomplished after extracting the first bicuspids; and, what is of the greatest importance, the positions of the lower teeth and the original malinterdigitation of the buccal cusps are not disturbed.

This, in the author's estimation, after the eruption of the second molars especially, is a principle of far more value than the accomplishment of an artificially posed ideal occlusion, obtained at the expense of moving all the upper and lower buccal teeth to unnatural positions, to say nothing of the probability of placing them in abnormal dento-facial relations.

The four cases shown in Figs. 37 and 38 will serve to illustrate a comparatively few of the many of this class which have fallen to my practice. In every instance the first or second bicuspids were extracted, and the teeth brought to a good masticating and retaining occlusion, with an endeavor to preserve, or restore with the least necessary movement, the original interdigitation of the cusps which Nature had produced or striven for.

Fig. 38.



In a large proportion of these cases, the teeth are normally inclined, with the roots and alveolar process in which they are placed in an equally protruded relation, and with the production of a heavy unesthetic bulginess over the entire upper dento-facial area, showing that a retruding movement of the roots of the labial teeth, as well as that of the crowns is often demanded to correct the facial outlines.

I have explained why these cases should not be corrected by an attempt to tip the crowns of all of the fourteen upper teeth back to the extent of their abnormal protrusion, and also why the practice is radically bad which teaches the reciprocal shifting of the crowns to normal occlusion. This sort of teaching may deceive a good many for a time, but fortunately, truth and the higher ideals and possibilities of the art will prevent it from deceiving everyone all the time.

Protrusions of Upper with Retrusions of Lower. As before stated, between the two above extremes — *i. e.*, retrusion of lower and protrusion of the upper

will be found every gradation of dento-facial inharmony that may be produced with this special malocclusion.

Figs. 39 and 40 show four examples of a distinct and very common dento-facial type of Class III, having exactly the same disto-mesial malocclusion of the teeth as in the two former types, and which may be considered an intermediate gradation or composite of those extremes. In these cases, a decided protrusion of the upper, accompanied with a retrusion of the lower, frequently appears far more pronounced than it really is. The correction of the facial outlines demands about an equally reciprocal antero-posterior movement of the upper and lower dento-facial areas.

Fig. 39.

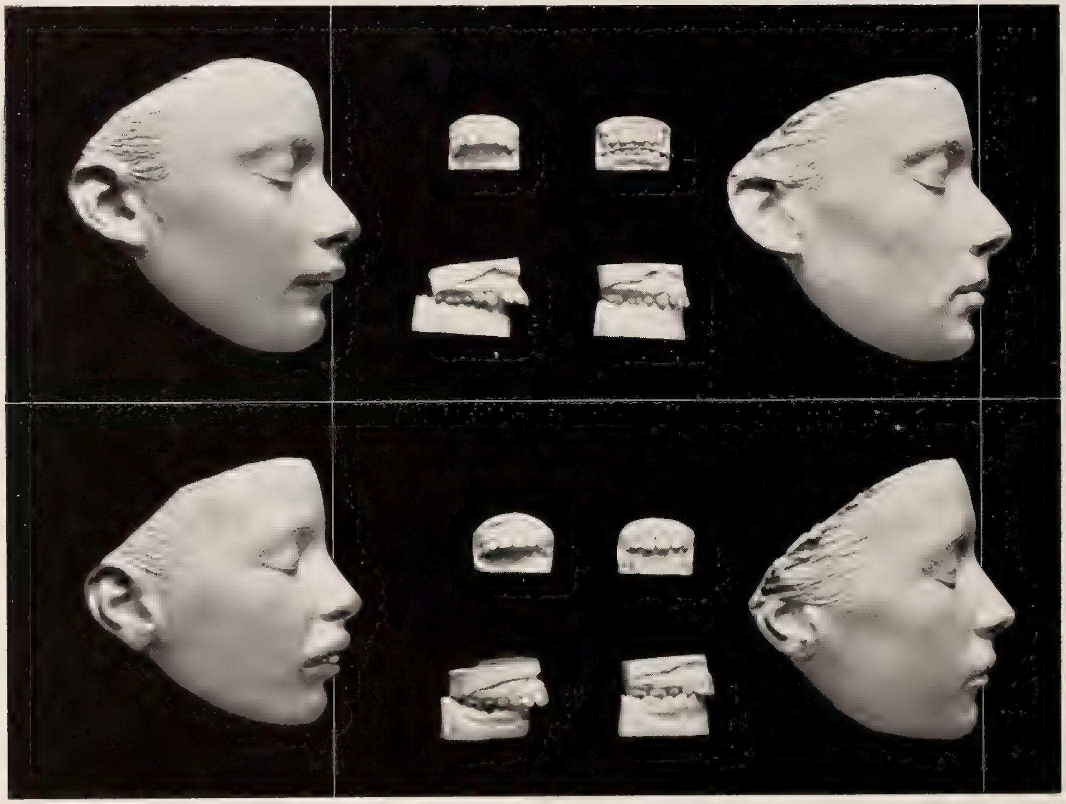
If treatment be commenced before the eruption of the second molars, or soon thereafter, many cases may be corrected without extraction by an antero-posterior movement of the upper and lower teeth, through a proper application of the inter-maxillary force.

In a very large proportion of these cases in my practice, however, and especially those in which the upper protrusion is more pronounced than the lowerr etrusion, and the buccal cusps are in full malinterdigitation, the second or first upper bicuspids are extracted: then all the lower teeth and upper molars are moved equally forward, preserving their original occlusion. At the same time the upper labial teeth are moved backward to close the bicuspid spaces, thus safely correcting the facial outlines with an avoidance of the difficulties and dangers of an ex-

tensive distal movement of all the upper buccal teeth, and with a greater assurance of permanent retention.

The first case in Fig. 39 is that of a girl 14 years of age, corrected in 1895. The second is that of a young man 17 years of age, corrected in 1896. In addition to extracting the upper first bicuspids, in the second case, a supernumerary right lateral was also extracted. Notwithstanding the fact that three teeth were taken from the upper, the arch when corrected was perfect in outline, occlusion, and dento-facial relations. As stated elsewhere: In all cases where the extraction of bicuspids is demanded, if the malposition of the teeth is properly corrected, the absence of teeth from the arch is hardly discernible, while the occlusion with masticating interdigitation of cusps should be always attainable. But this does not assert that the teeth will remain in the corrected positions unless properly retained,— the one being quite as important as the other.

Fig. 40.

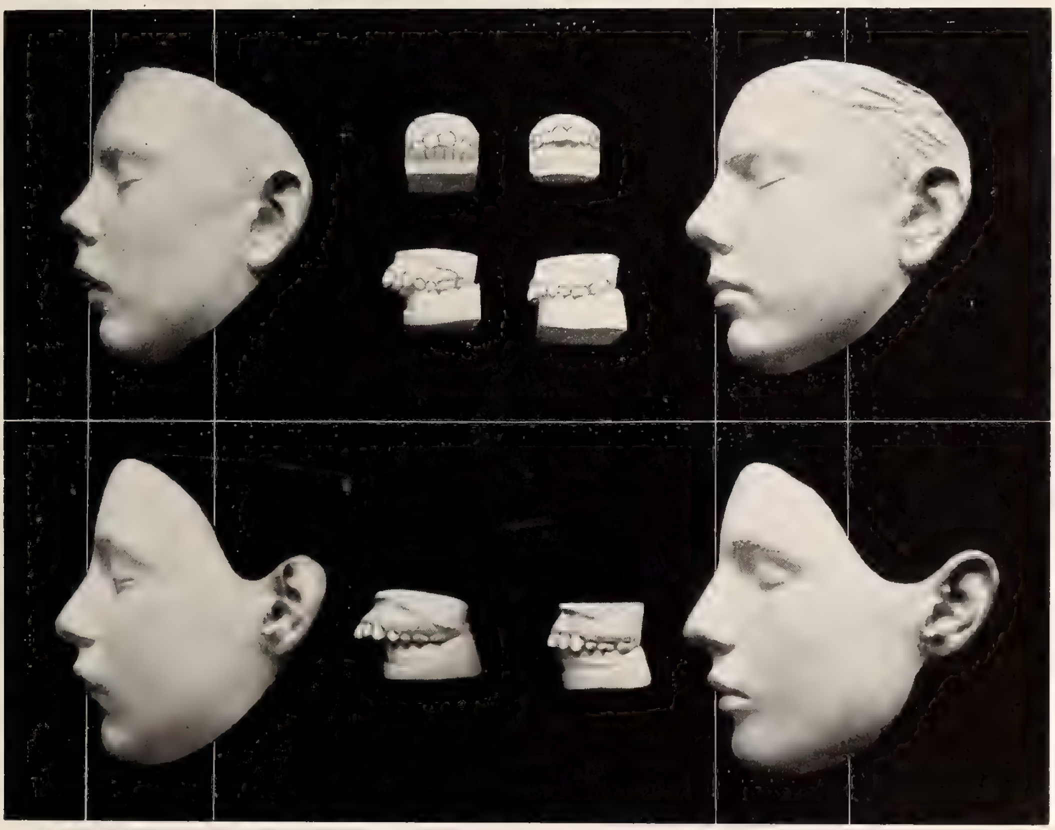


In the first case of Fig. 40, which was corrected in 1906, the pronounced upper protrusion in connection with quite a decided lower retrusion was largely due to wide interproximate spaces between the labial teeth. As the patient was only 13 years of age, it was hoped to correct the dento-facial inharmony and bring the teeth to a normal occlusion without extraction, principally through the action of the intermaxillary and occipital forces. It was found, however, after the closure of the interproximate spaces, the upper dento-facial area was far from corrected, which was due largely to the fact that the roots of the upper labial

teeth were also protruded, producing quite a decided prominence of the upper part of the upper lip. It was, therefore, decided to extract the first bicuspids and employ Apparatus 83, for retruding the roots. See the photograpic result of this case on p. 307. The fourth case shown was corrected principally with **Ap. 77** and completed in 1906.

Upper Protrusion with a Retrusion of the Lower Jaw and Teeth.—There is still another distinct type of dento-facial inharmony shown in Figs. 41 and 42, in which this same character of malocclusion of the teeth obtains. See Type C, Class III. It differs from the second group, or typical upper protrusions, in that the lower jaw and chin is deficient or retruded as compared to more perfect facial outlines. I wish particularly to call attention to this type, which is

Fig. 41.

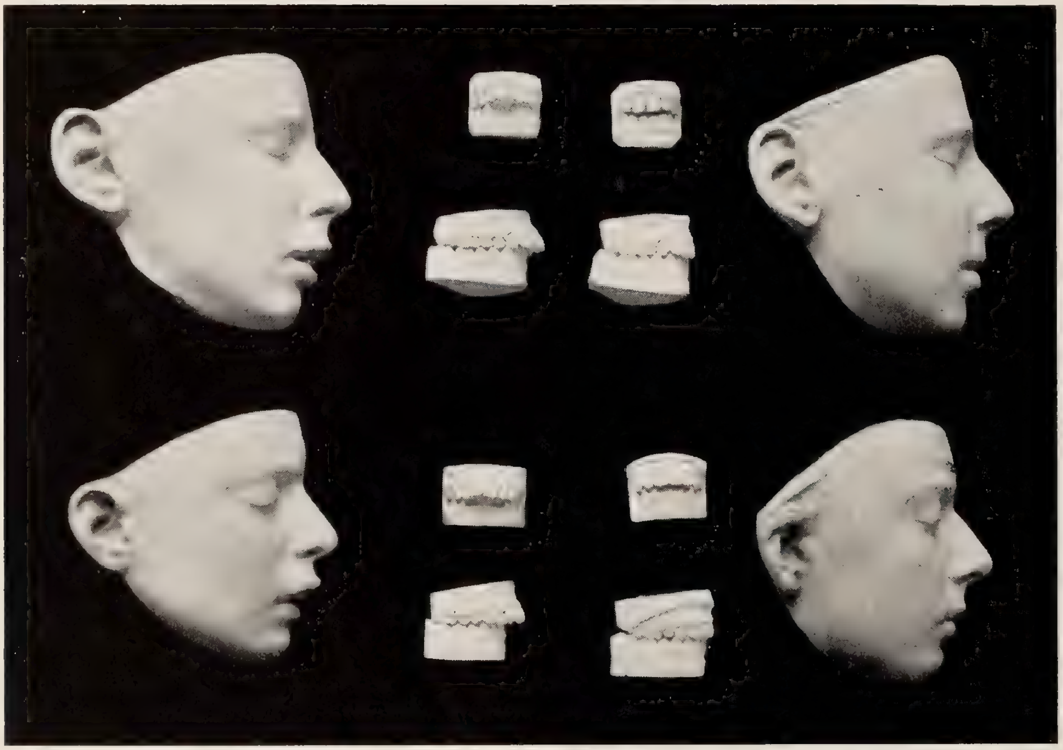


quite common, because it will be seen that when the lower teeth and lower lip are not retruded in relation to the chin, a protruding movement of the lower teeth to aid in correcting the occlusion will be very liable to give a **receding chin effect.** Therefore this type demands even more strongly than the second group the extraction of the upper first bicuspids, with the view of retruding the labial teeth the full distance allowed by the space. In some instances the full interdigitating correction of the occlusion may demand a further retrusion of all the upper teeth. It is needless to say that the principal force is the **occipital.** The dental stationary anchorages attached to all the upper buccal teeth are employed only to take

up the slack of the retruding bow and thus retain the movement as it is gained. If the intermaxillary force is employed, the lower teeth should be thoroughly anchored to prevent a forward movement, unless this also is demanded.

It will be seen that I have here presented the results of treatment in **eighteen cases** of decided disto-mesial malocclusion, to be fairly compared with the **three cases** of a similar occlusion exhibited at the said Symposium. In all of these cases the upper buccal teeth in relation to the lower were about the width of a bicuspid in front of a normal occlusion.

Fig. 42.



I have purposely selected **six typical cases** which demanded correction without extraction, and **twelve** which demanded the extraction of the first or second bicuspids for their perfect correction, as it is about in that proportion, in this character of occlusion, that the two methods of treatment — **non-extraction** and **extraction** — are respectively demanded.

In all of these cases after correction the final occlusal relations were so perfect that one would never stop to think whether it were a normal occlusion or not, unless intent upon the discovery. In fact, in those cases in which the first bicuspids are extracted and the front teeth are properly moved back to close the spaces with the least possible movement of all the other teeth, the occlusion for mastication with interdigitation of cusps is frequently quite as perfect as it could be if typically normal; and what is of quite as much importance, the teeth in these cases are far more liable to retain their position than where all of the teeth

are shifted disto-mesially to a normal occlusion. But the main thing, after all, is that the **facial outlines** and not the relations of the dentures to each other should always determine the movements demanded and the character of good occlusion it is best to establish.

Protrusion of the Upper Apical Zone

Among the many contributions offered at the Symposium to show the baneful effects which follow the extraction of teeth, there were exhibited two cases which I had corrected over ten years before, by extracting the first upper bicuspids. To speak exactly: the said teeth in these cases were extracted December, 1893, and May, 1894, respectively.

As the criticism came from one of the exponents of the "new school" teaching, and in as much as it pertains directly to the subject of this chapter and refers to a type of protrusions (Type E, Class II, Protrusion of the Roots of the Upper Front Teeth) which has not been mentioned, I will take the liberty to give here a revised résumé of my first reply, purely for the purposes of teaching.

Fig. 43.

Fig. 44.

One of these cases was that which is very poorly illustrated in Fig. 43. It was described in a paper read before the Odontological Society of New York, March 19, 1895, and published in the International Dental Journal as follows:

"Miss R., aged 22, commenced treatment December 17, 1893; staying bands October 3, 1894. The unusual time required for this operation was due to the age of the patient, and consequent impossibility of effecting a more rapid movement

of the teeth. It will be observed by an examination of the casts that the first superior bicuspids were removed and the space subsequently closed — not so much by a backward movement of the crowns of the anterior teeth as by a forward movement of the molars, due to the great anchorage force they were obliged to sustain. It will also be observed by a careful examination, that the cervical portions of the incisors have not materially changed their relative position, though the apices of their roots must have moved back at least three-eighths of an inch, judging from the present inclination of these teeth and the marked depression of the covering tissues as compared with the first casts. The cuspids did not originally stand at the same inclination as the incisors, nevertheless it will be observed that the roots of these teeth, which always offer the greatest resistance, have moved appreciably. What to me is more to the point and of infinite importance, compared with the correction of the dental irregularity, is the remarkably beautifying effect produced on the face of the patient by this slight change, which, I must say, the models inadequately express. For further proof of this statement, I am pleased to be able to refer you to a man whom you all know, Dr. A. W. Harlan, who referred the case to me."

The second case (see Fig. 13, p. 302) was described in a paper read before the Tri-State Dental Meeting at Detroit, June, 1895, and published in the Dental Cosmos, Dental Register, and Ohio Dental Journal, as follows:

"Case II is that of a young man who was 18 years of age when I commenced treatment, a little over one year ago. The teeth were large and strong; jaws and bones proportionately large and rigid. The facial prominence or bulging of the face in the region of the wings of the nose was quite pronounced — unfortunately due largely to the anterior position of the roots of the cuspids. This condition, more or less intensified, is not an uncommon one. If you have not often observed it among your patients and others, it is because you have not learned to classify it among the conditions which demand your skill, inasmuch as the teeth of these patients are often in proper alignment; through long habit in practice you proceed to treat them with little heed to the facial defect which their position produces. If you think of it at all, it is merely to become conscious that the face is homely, plain, or ugly — made that way — unchangeable; and so the subject is dismissed as one which makes no appeal to you. Yet this, as well as many other facial imperfections produced by a malposition of the teeth, is a condition which if taken early can be remedied with no great difficulty; and in doing so you will confer one of the greatest of human blessings. After the first bicuspids were extracted, anchorage attachments were made for the posterior teeth as before, but the reciprocating force bars extended only to the cuspids. The anchorage was further reinforced in this case by rubber bands extending from the upper attachment of the cuspids to the posterior ends of the bar that was attached to all of the lower teeth, as has been repeatedly described by me elsewhere. The power of this apparatus was continued from May, 1894,

for eight months, since which time to June 10, 1895, the incisors have been included by an extension of the force bars. I removed the apparatus at this time for the purpose of taking impressions to bring the models of the case before you in its present incomplete state."

"The bicuspid spaces have been closed partly by the forward movement of the anchorage teeth. The roots of the cuspids, which seemed to present an almost insurmountable resistance to far more force than I have ever employed in any other case, have moved appreciably, but not as much as I hoped. I leave it for you to judge of the improvement, which is quite marked in some particulars, not shown by the face models, and due to the regulation of the incisor teeth."

The facial cast of the completed case is shown in Fig. 14, p. 303, Class II.

The following is the said criticism of these cases, which may be taken as a fair sample of many similar instances from the standpoint of the advocates of non-extraction in Orthodontia. See Items of Interest for August, 1905, page 632. After throwing upon the screen Fig. 43, our learned (?) critic said: "This picture is from a photograph of a print in an essay read before the Odontological Society of New York, in which special attention is called to the esthetic appearance of the face after the treatment. Look closely at the occlusion and you will observe that it is not occlusion, but merely antagonism. Look at the face after operation; it has a heavy line posterior to the nose, and the lower lip has too great a depression in it. Before the operation, attention is called to the protrusion of the upper lip. Bicuspids were extracted and the roots of the upper cuspids and incisors were retruded. But it was not necessary. The face needed the filling out in the lower lip, and as proof let me point to the fact that the lower first molars had been lost and the lower teeth had shifted backward. What this case needed was the expansion of the upper arch, also the lower, and the insertion of artificial substitutes for those lost molars. How much better the face would have been then."

Of the second case (Fig. 13, p. 302) he said: "This picture shows another case where the upper first bicuspids had been extracted, and the heavy molar and bicuspid anchorage had not been stationary enough to prevent a shifting forward. And yet the author claims that all the movement has been done in bringing backward the cuspids and the incisors. Look closely at the occlusion and see where the motion was. Look at the face! Is it refined? I say it is not. The profile is better, but not so the contour. With the distal movement of the upper arch and the mesial shifting of the lower, the face in this case would have the proper contour and profile. These last figures are also a direct contradiction of Dr. Case's claim that classification of malocclusion should be based on the facial deformity produced. It is easy to fall into error from such a classification. Let us classify malocclusion from the teeth, and prove it with the facial contour."

One might be inclined to think this verdant effort was purely that of honest though mistaken artistic judgment, were it not that he seeks to strengthen his

argument by a deliberate falsification of *both* of my published statements, when he says, "And yet the author claims that all the movement has been done in bringing backward the cuspids and the incisors."

Now let *me* ask the reader to carefully examine the occlusion. In the beginning dental casts of Fig. 43, note the mesial malocclusion of the upper bicuspids in relation to the lower. If the lower teeth moved backward after the extraction of the molars, they could not have done so to a sufficient degree to jump such a perfect malinterdigitation of the cusps. Whatever movement may have occurred in this way was only that which was permitted by a general retruding movement of all the upper teeth. This is possible, to a moderate degree, though the partial closure of the molar spaces was doubtless due mostly, as in other cases, to the mesial drifting of the back molars.

Be that as it may, it does not remove the **unassailable fact** that the entire upper arch was originally protruded the full width of a bicuspid, with a decided protrusion of the upper dento-facial area. In cases of this character older than twenty, with teeth crowded closely together in arches of normal width, it is simply foolish to say they can be properly corrected without extraction, and when the roots of the labial teeth are protruded in this way, or with the crowns also, it is equally foolish to assume that the apical area does not demand retruding quite as much as the crowns, to properly correct the facial deformity, or that this may be accomplished with the ordinary methods of applying force to the crowns, or with other than the **contouring apparatus** which was first published in conjunction with the intermaxillary force in 1893. Why will not intelligent men who aim to accomplish the highest possible good in their art see these things — which require such a very ordinary quality of common sense? Why will men continue to blindly assume that the mere tipping of the crowns of the labial teeth backward or forward is sufficient to correct decided protrusions and retrusions of the apical area? — when they must know the tendency of such a force would always be toward the opposite direction of movement at the ends of the roots, which will not be restored by Nature except in rare instances. And even under very favorable conditions of youth, it is not advisable to depend upon this inclination movement of the crowns where there is an extensive retrusion of the roots and intermaxillary process, especially as it can be so surely corrected by artificial force.

When this case presented, the bulging prominence along the upper part of the upper lip, almost completely obliterating the naso-labial lines, flaring the nostrils and forcing the end of the nose forward and up, produced the expression which is sometimes seen with patients suffering from a severe alveolar abscess in this quarter. This being coupled with the fact that the lips closed with an effort, and when talking or laughing rose to an unpleasant exposure of the entire crowns and a portion of the gum above, the case presented one of the most unhappy dento-facial deformities it has ever been my fortune to correct. Compare this

with the finished result — the entire removal of that protruded appearance, with nose corrected, graceful naso-labial lines, lips that can now close with perfect ease and pose, and with normal mobility in action. It seems to me that anyone with a little artistic sensibility can plainly understand the truth of all this while viewing the pictures of the profile models, even though unable to fully appreciate the real conditions.

For the benefit of the critic and his sympathizers I have procured the photograph of this young lady, taken several years after treatment, from which Fig. 44 is reproduced. I have placed it next to Fig. 43, that it may be observed how closely the facial outlines of the photograph from life follow the outlines of the finished plaster model.

It is particularly gratifying to me to call attention to this in view of the frequent statement that plaster models made from plaster impressions of the face are not as perfect in outline as photographs.

It must be remembered that the main object in this case was to correct the facial deformity and leave the patient with a good masticating occlusion. Though the cusps of the second bicuspids in the final cast are not in perfect mesio-distal interdigitation, the cusps were ground to give good antagonizing surfaces, while the lower second bicuspids antagonized perfectly in the sulci of the upper molars, and the mesial movement of the second molars brought the molar occlusion to nearly normal relations.

Now let us see what would have been accomplished by the so-called modern methods of **non-extraction** and **reciprocal disto-mesial movement** of the upper and lower teeth.

We will assume for the sake of argument that the critic would have jumped the cusps of the bicuspids as he says, and placed the occluding surfaces of the remaining molar teeth in normal disto-mesial occlusion and sustained the new position with the lower artificial molars. Would he have accomplished this by a partial or even appreciable distal movement of the upper buccal teeth? No — not for patients twenty-two years of age, with full and crowded arches, before the eruption and consequently before the possibility of extracting the third molars. And even then, had it been possible, it would have been a tipping movement which would have increased the already lingual inclination of the labial teeth. If anything, it would have enhanced the already protruded effect of the incisor roots. Then how would he have accomplished his correction? Only by a protruding movement of the lower bicuspids and labial teeth the full width of a bicuspid. In order to do this it would have been necessary to also protrude the crowns of the upper incisors — the cutting edges of which touched at points the labial faces of the lower incisors near their gingival borders.

If any orthodontist is so lacking in the common requirements as to be unable to see what effect upon the facial outlines such treatment would produce, I would advise him to turn his attention to other departments of dentistry.

It is needless for me to say that it would have **increased** the already **protruded deformity** of the upper, and by protruding the lower, would have obliterated the much-desired labio-mental curve to the lower lip, with a probable **receding chin effect,** which is frequently seen with decided **bimaxillary protrusions** — a condition which the above movement would have surely produced. By still further straining the labial tissues over the protruded framework, the lips would be deprived of the proper redundancy for mobility of action and possibilities of perfect closure. All for what? To satisfy an absurd sentiment that God does not make the same mistake in the number and natural positions of human teeth as one sees repeatedly in other osseous portions of the facial framework, and therefore (as the false theory runs) by shifting the crowns of the teeth to normal occlusion, it will be found "that the full complement of the teeth is necessary to establish the most pleasing harmony of facial lines."

I wonder if the time will ever come when men of good common sense in other things will fully appreciate the fact as true, that the natural malpositions of the teeth in phalanx, in relation to dento-facial harmony, are quite as frequent as malpositions of other bones which characterize features of the physiognomy in relation to facial harmony; and that this malposition of the teeth is not merely that of the crowns, but that it more often than otherwise pertains to the roots as well, and to the alveolar process in which the roots are imbedded — in fact, to the whole dental portion of the jaws, which seems to be shaped in conformity to the general malposition of the teeth.

As the second case, shown in Fig. 13, p. 302, was exactly the same type of dento-facial irregularity as the former, all that has been said in regard to that case applies equally to this; except what related to the loss of the lower molars and the final result in occlusion, which in the latter case appears to have more nearly retained the original masticating interdigitation of buccal cusps. It should be remembered, also, that this case as shown was not finished when presented at the Michigan meeting. The final facial result may be seen in Fig. 14, p. 303.

CHAPTER XV

DENTO-FACIAL DIAGNOSIS

Introductory. — This chapter relates particularly to those irregularities of the teeth which produce **dento-facial inharmonies** and the specific methods that should be employed in determining the **class** and **type** to which they belong, that those who practice dental orthopedia may be the better prepared to skillfully treat these conditions from the standpoint of applied science and art. The author wishes it to be distinctly understood that he does not underrate the value of an intelligent consideration of the relations which the upper and the lower teeth bear to each other and to that of a **normal occlusion**. His reasons for believing that a **normal occlusion** of the teeth should not be considered as the **sole** basis in diagnosis and treatment of dental irregularities has been abundantly pointed out in previous chapters.

It is always possible and it is usually not difficult to produce a normal occlusion by a judicious application of intermaxillary force. But the question should always arise: Will such an extensive movement of the teeth as this often portends leave the overlying features undeformed, or as perfect as might be produced with a lesser movement which would secure to the patient fully as perfect masticating forces and with a greater probability of permanency of retention? In a very large proportion of all irregularities it should be the highest aim to leave the patient with a normal occlusion, but in this attainment the movements of the teeth should always be upon the basis of their real dento-facial relations.

Scope of the Dento-Facial Field

Upon entering the field of dento-facial irregularities and their treatment, it would be well for the student to first deeply consider the scope of this department.

Dento-Facial Orthopedia is confined to a comparatively small area of the human physiognomy. The labial teeth and the alveolar process in which their roots are imbedded and the incisive portion of the upper jaw, constitute the principal extent of the framework which it is possible to move with dental regulating appliances.

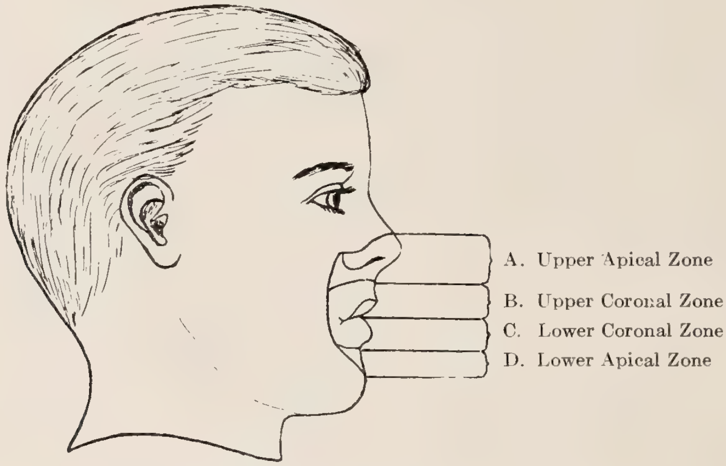
While a lateral expansion of the arch — especially the upper — will often produce a more rounded fullness to the cheeks, it is not due so much to the direct support of the buccal teeth as to the relief of tension upon the labial and buccal tissues that has followed the concomitant retrusion of the front teeth which the expansion permitted. In regard to changing the position of the chin, it is quite rare that one has an opportunity to apply force at a sufficiently early age to re-

trude the mandible with occipital pressure, while a permanent movement of the mandible in the opposite direction, in the operation of "jumping the bite," is very uncertain. Therefore we must place the chin on the outside of the **dento-facial** area proper, and as one of the most prominent landmarks of the physiognomy from which to draw comparisons in diagnosis.

The Dento-Facial Area

The principal portion of the human face, therefore, which it is possible to beautify by moving the teeth and alveolar process, is that formed by the upper and lower lips, and lower portion of the nose, bounded laterally by the naso-labial folds and below by the chin. This is the **"dento-facial area."** See Fig. 45.

Fig. 45.

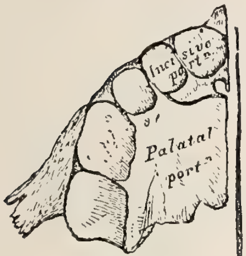


Within this ovoidal area, the slightest change of muscular movement expressive of the emotions will produce an apparently marked effect upon the physiognomy. The same is true of any physical imperfections of contour, particularly around the mouth, which will seem to change the entire features. It is here that an inherited or acquired lack of symmetry in the size, shape, or position of the teeth and jaws produces those marked changes of facial contour which characterize the several classes of dento-facial irregularities. In nearly all cases of decided protrusion or retrusion of the roots of the upper labial teeth, the incisive portion of the maxillæ, with its anterior nasal spine and cartilaginous nasal septum, will be protruded or retruded in its dento-facial relations. As this is the framework which supports the extreme upper portion of the upper lip and forms the base of the entire lower portion of the nose with the naso-labial depressions on either side, including the end and wings of the nose, the form and relative position of this facial zone will be frequently affected to a marked degree in certain characters of protrusions and retrusions of the upper teeth. In most cases for youthful patients this zone is susceptible of being changed considerably in the outlines of

its contour, by a bodily protruding and retruding movement of the teeth, as it fortunately happens to be a fact that all of that portion of the superior maxilla in which the incisor teeth are developed with its alveolar ridge, will be carried bodily with the roots of the incisor teeth in a protruding or retruding phalanx movement. This may be largely due to its early separate development.

From Gray's Anatomy. — Gray, in describing the superior maxilla, says: "In some bones a delicate linear suture may be seen extending from the anterior palatal fossæ to the interval between the lateral incisor and the canine tooth. This marks out the **intermaxillary** or **incisive bone.** It includes the whole thickness of the alveolar process, the corresponding part of the floor of the nares, and the anterior nasal spine, and contains the sockets of the incisor teeth. . . . . . The incisive portion is indicated in young bones by a fissure which marks off a small segment of the palate, including the incisor teeth. (See Fig. 46.) In some animals this remains permanently as a separate piece, constituting the **intermaxillary bone**; and in the human subject, where the jaw is malformed, as in cleft palate, this segment may be separated from the maxillary bone by a deep fissure extending back between the two into the palate."

Fig. 46.



Inferior Surface.

A bodily protruding or retruding movement of the roots of the lower labial teeth and alveolar ridge, which constitute the framework that supports the labiomental area, will be found far more difficult to accomplish than a like movement of the upper.

Zones of Movement

The **dento-facial area** shown in Fig. 45 is naturally divided into four transverse segments or zones of movement, according to the areas that can be affected **separately** by a movement of the crowns or of the roots of the underlying teeth and alveolar process. If the upper labial teeth are moved bodily backward or forward, the two upper dento-facial zones, A and B, will respond in proportion to the movement. The same is true of the two lower zones, C and D, if the lower incisors are moved bodily. Again, force may be so applied as to move any one of these dento-facial zones mainly, or it may protrude one zone and at the same time retrude another. These principles, within the possibilities of force described in Chapter VIII, are of the greatest importance in the esthetic correction of facial outlines, and are among the main principles of the science which have tended most to raise this branch of dentistry above the ordinary methods of **Orthodontia** in which the crowns of the teeth alone are moved.

In Fig. 47, the profiles on the left show a **full upper protrusion** and a **full upper retrusion** respectively. The central profiles were made after the crowns alone had been retruded in the one case and protruded in the other. It will be seen in these intermediate stages of both operations that the upper apical zones are

Fig. 47.

practically unchanged; in fact, in the upper profile the protrusion seems enhanced. The profiles on the right were made after the roots had been retruded in the one case and protruded in the other, with a fairly perfect correction of facial outlines. Note the changes which took place in the two entire upper dento-facial zones, even to the ends of the noses. The two upper zones of any youthful case may be moved separately, together, or in opposite directions with an equal probability of success.

In Fig. 12, p. 298, (Type D, Class II), is shown the models of a case in which there was quite a marked retrusion of the upper apical zone and a slight protrusion of the upper coronal zone. This was perfectly corrected by a reciprocal protruding and retruding movement of the underlying roots and crowns respectively. On the other hand, Figs. 43, p. 169, and 13, p. 302 (Type E, Class II), shows exactly the opposite malposition and the effect of the movement in correction.

The Facial Outlines in Diagnosis

In the correction of all dental irregularities, the facial outlines should be considered as the guide for determining the antero-posterior positions of the teeth as compared to the normal dento-facial relations. They point the course to be pursued in the correction of occlusion and alignment of the teeth. To illustrate this, examine the dental casts of five distinctly different characters of irregularity shown in Fig. 26, p. 141, Chapter XII, which are described in the text. In all of these, the upper dentures are about in the same decided anterior malrelation

to the lowers; and were there no other guides than dental relations, they all might be treated alike — possibly as upper protrusions. But the facial outlines produced by each one of these malpositions of the teeth tell us that no two of them are the same character of irregularity, and that each one of them demands a certain movement of the teeth, for the correction of this similar malocclusion, that differs quite widely from the others.

Observation Training

In training the mind to a fuller appreciation of the needs of this department, one cannot do better than to study unobtrusively the faces met with in the suburban cars and local transits of a large city. In a face under observation, note the general character and relations of the various parts of the principal features, or unchangeable area, shutting out for the time the **dento-facial area.** Note the relative position and **pose of the chin** with the malar prominences, forehead, bridge of the nose, etc. Then turn to the **dento-facial area,** or that portion of the physiognomy that it is possible to change in dental orthopedia, — its general and localized relations from an esthetic standpoint. Compare the outlines of the **dento-facial zones** with each other and to the adjoining areas of the physiognomy outside of this sphere of possible influence. Note first: the character and shape of the **chin** and its relations to the **lower lip.** Do the lines of the **labio-mental area** form a graceful and concave curve to the border of the lip, or are they abnormally deep with pointed chin, or straight with character lacking? Second: the antero-posterior relations of the **upper** and **lower lips** to each other; the lips in repose and in talking or laughing; do they close with ease or with a muscular effort? Is the natural parting of the lips even with the occlusal plane of the teeth, or does the lower lip lap over the upper incisors? Is this due to a short upper lip, or to an abnormal extrusion of the upper labial teeth? Third: note the **shape** and **relations** of the **upper lip.** In its perpendicular lines is it slightly concave, as it should be, or is it straight or convex? At its lateral boundaries, in repose, does it gracefully curve with a slight deepening of the **naso-labial lines** where it joins the cheeks? Or is the entire upper lip protruded, with a partial or complete obliteration of the naso-labial lines, and with that peculiar heavy prominence of the middle features which produce the effect of a **retruded lower jaw,** or one lacking in normal development? Or is the entire upper lip retruded with an abnormal deepening of the naso-labial lines and retruded **facial seating** of the lower portion of the **nose,** which produces the effect of lower prognathism?

Practical Diagnosis

When these oft-repeated observations are put into practical use in contemplating the treatment of a dental irregularity, the first thought of the operator should be directed to the physiognomy in an intelligent and critical observation of

the temperament, age, development, the character of the facial outlines, the character of the occlusion, especially that of the first molars, and finally the probable causes.

This may usually be accomplished without special display, or the occupying of more time than would be necessary for examining the teeth. In fact, it may require but a glance to show that the case does not belong to any of the classes of Protrusion or Retrusion, and that you may expect to find it belonging either to the Simple and Complex Groups, or to Class I. In the latter class the malposition of the cuspids does not always markedly affect the facial contours. If, however, the case is seen to belong to the dento-facial division, it may require a far more careful observation extending through several sittings to determine in which special class or type it belongs. This study may demand a full acquaintance with all the relations — the teeth to each other, their occlusion, the relation which they bear to the facial contours, and the esthetic relation which different zones of the dento-facial area bear to each other and to other portions of the physiognomy.

In the study of a physiognomy with the view of determining the particular **facial inharmony** and **class** in which it belongs in order to outline the proper course of treatment, the head of the patient should be in an upright position somewhat in a line with that of the observer, and the face studied from different angles while in repose and in action. The facial cast will be of great value for studying the outlines in the absence of the patient.

A Basic Principle: — While looking at the profile in repose, the first thing to determine is the relative position of the **chin** to the **forehead, malar prominences,** and **bridge** of the **nose**. If its position is harmonious to the **unchangeable area,** and the lower lip is well posed, it indicates that the lower front teeth are in normal dento-facial relations and if the facial outlines are imperfect their correction should be made, if anywhere, by moving the upper teeth.

Relative to Lower Irregularities

If the lower teeth in the above case are irregular, their correction should be accomplished by a lateral expansion of the arch if need be, and without disturbing the antero-posterior position of the labial arch. This irregularity of the lower may consist in a malalignment of the cuspids or bicuspids in a crowded arch and if caused by the premature loss of buccal deciduous teeth, which has permitted the first permanent molars to drift forward and the arch to become more or less contracted, this should be corrected and the molars unhesitatingly retruded with the combination of intermaxillary and occipital forces in order to make room for the malaligned teeth without changing the relations of the front teeth.

However, after the eruption of the second molars, if the lower buccal teeth have drifted forward to a complete malinterdigitating occlusion with normally posed uppers, or if in normal occlusion with protruded uppers, with the cuspids in marked malalignment and the lower lip not retruded in its relations to the

chin, any attempt to retrude the buccal teeth, more than a slight degree to correct the cuspids would be inadvisable if not impossible. On the other hand, to protrude the incisors sufficiently to place the cuspids in alignment might be equally inadvisable because no facial imperfection is more unpleasant than a protruded lower lip, with an obliteration of the graceful labio-mental curve beneath, which always produces the effect of a receding chin. Therefore, rather than produce such a condition, the extraction of bicuspids to correct the lower

Fig. 48.

Fig. 49.

irregularity would be advisable. This is well illustrated in Fig. 48. The profile on the left shows the effect upon the chin of protruded lower teeth. That on the right, with Fig. 49, shows the effect of a retruding movement of the lower labial teeth after extracting the bicuspids.

This case which is here used as an object lesson is fully described in all its dento-facial bearings and treatment in Chapter XII, where it is illustrated by Fig. 23. The same facial casts were photographed at a slightly different angle for Fig. 48, to show more clearly the dento-facial protrusion in relation to the chin, at the beginning of the operation, especially the cuspid prominence of the upper lip, which is in marked evidence on the cast.

Upper Irregularities

Let us assume in the case under diagnosis that the chin and lower lip are in harmonious relations to the principal features of the physiognomy, and that the

lower teeth are not irregular. Attention should then turn to the real irregularity of the upper teeth.

Simple and Complex Malpositions.— If the malposition of the upper is one that belongs to the Simple and Complex variety of irregularities and possibly complicated with two or more malpositions of this division, the disto-mesial occlusion of the molars will be normal or nearly so, and whatever the jumbled positions of the teeth, they should be corrected without extraction.

Maleruption of Cuspid or Class I.—If the case is one that is characterized by crowded maleruption of the cuspids, or one of its variations, differentiate between the two types of this class, which are quite different in occlusion and dento-facial relations and consequently demand very different treatment. See Chapter XXIV, Class I.

It may be you noticed upon seeing the patient that it was a decided protrusion or retrusion of the upper, with those characteristic positions of the upper teeth, lips, and facial expression which, to experienced eyes, are unmistakable when once seen.

Upper Protrusions or Class II

If the case at first appears to be a **protrusion of the upper,** or Class II, be sure that it is not a retrusion of the lower, or Class III, or that the protruded relations of the upper lip and teeth, as compared to the lower, are not due **partially** to the retrusion of the lower.

Fig. 50.

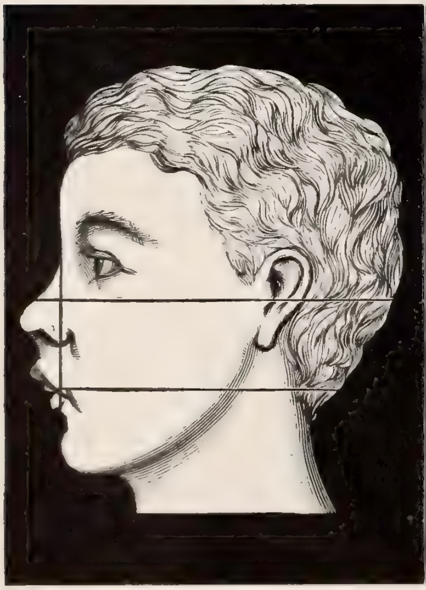


Fig. 51.

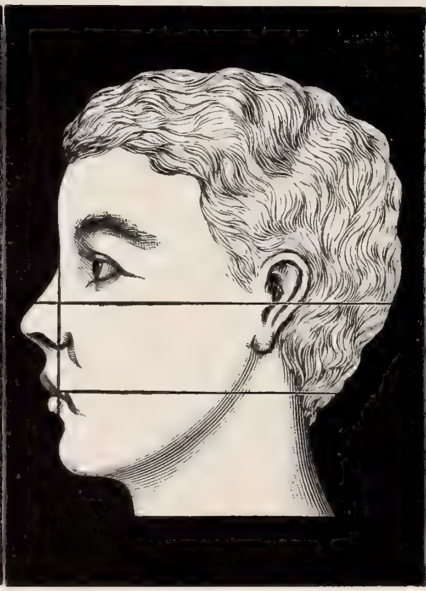
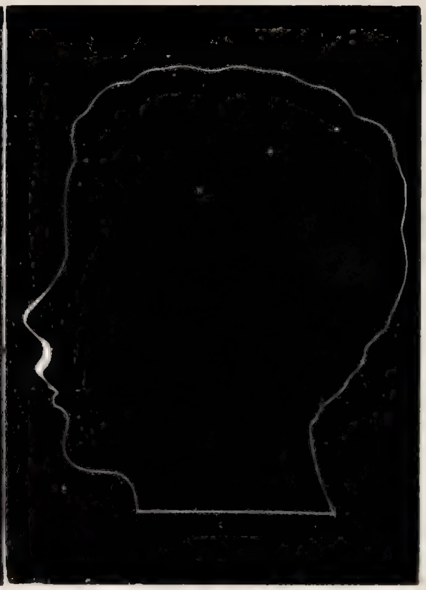


Fig. 52.



But do not be deceived by **an effect** of a retruded lower, which an upper protrusion will usually produce. This is well shown in Figs. 50 and 51, which are drawn exactly alike in every particular except a difference in the profile outline of the upper lip and end of the nose. The exact amount of the difference is seen

in Fig. 52. The figure will also illustrate how a comparatively little change in a small area of the physiognomy, which may be accomplished by a proper application of force to the upper labial teeth, will produce the effect of a far more extensive physical change, and one that will alter the entire expression of the features. This, no doubt, is partly due to the fact that the most marked unesthetic features are reduced and brought into more perfect harmony with the whole, which shows how necessary it is to have the proper conception of artistic relations, to determine the real character of a dento-facial irregularity, and thus produce the required movement for the most perfect correction.

Type A, Class II. — In evident **upper protrusions,** if we have found that the lower teeth, lip, and chin are in esthetic pose, attention should be given to the occlusion to determine the real type of the upper protrusion and the treatment to be pursued. If in examining the occlusion we find that the disto-mesial relation of the buccal teeth is normal or nearly so, with upper arch laterally contracted, the front teeth and incisive alveolar ridge labially inclined, and with the exhibition of wide interproximate spaces caused by the protrusion of the front teeth, the case will be that of Type A, Class II, to be corrected without extraction.

Type B, Class II. — If the upper buccal teeth occlude mesially to normal, fully the width of a bicuspid, and the cusps perfectly interdigitate, as they commonly will in upper protrusions, with a good mastication, though not normal closure, the case demands the extraction of the first bicuspids. To attempt to retrude all the upper teeth fully the width of a bicuspid, as would be necessary for a perfect correction of normal occlusion and facial relations in these cases, would be wrong, as pointed out in Chapter XII, and incontestably confirmed by Dr. Cryer in Chapter XI. This being decided, carefully examine the peculiar contour of the upper lip in all its relations to the unchangeable area. If the upper apical zone is not protruded and the labial teeth labially inclined, it indicates that the crowns alone are protruded, and that the case belongs to Type B, Class II, to be corrected as shown and described under **Ap. 75.**

Type C, Class II. — If, however, we find that the upper part of the upper lip is also protruded, with an obliteration of the naso-labial lines on either side of the wings of the nose, and that the teeth are normally inclined, it will indicate that the case belongs to Type C, Class II, and that the roots as well as the crowns are protruded,— to be corrected as described under **Ap. 77.**

Variation of Type B. — Again, if there is a moderate upper protrusion with the lower not retruded, and the buccal teeth occluding disto-mesially even with each other ("end to end"), or with the upper, one-half the width of a bicuspid in front of a normal occlusion, the case belongs to the variation of Type B. If this occurs with patients older than 14, with crowded upper arches, it indicates the extraction of the second bicuspids, to be corrected as described under **Ap. 76,** which premises that there is to be a reciprocal antero-posterior movement of the buccal and labial teeth to correct the occlusion. It frequently occurs that

the extraction of the first bicuspid on one side and the second bicuspid on the other is indicated, as above.

As strange as it may seem, this partial mesio-distal malrelation of the upper and lower cusps is not so very uncommon, and too, with a fairly good masticating closure, the cusps of one set striking fairly into the sulci between the buccal and lingual cusps of the other. If the patient with this occlusion is under fourteen years of age, and even with the lower not retruded, no teeth should be extracted until it is found impossible or inadvisable to retrude the buccal teeth to their normal occlusion, with the application of the intermaxillary and occipital fórces.

Diagnosis of Types D and E of Class II are fully explained under **Aps. 82 and 83.**

Deceptive Facial Effects

A lack of perfect harmony in the antero-posterior position of the chin will frequently be observed. The lower jaw is apparently protruded or retruded, so as to mar the esthetic perfection of the physiognomy. In a very large proportion of these cases the fault which seems to be that of the lower jaw will be found to be that of the upper teeth, which are abnormally retruded or protruded in the opposite direction. In other words, it is a common error to imagine the chin imperfectly posed because we naturally compare its relation to the upper protrusion or retrusion, instead of comparing it, as we should, to the more stable or unchangeable features of the physiognomy.

Bodily Movement of Lower Jaw and Teeth Considered. — While it is doubtless a fact that the lower jaw of a young patient can be more or less retruded in its relation to the upper with a properly adjusted headgear and chin-piece, a permanent movement in the opposite direction (that must of necessity be sustained by a decided structural osseous change of its joint articulation) has never been accomplished by the author, though repeatedly tried. Nor has he ever had the fortune to see **any case from the hands of others** that was **permanently successful** in that operation known as "jumping the bite."

If the lower jaw be mechanically protruded or retruded bodily, the lower teeth and lower lip will of necessity be carried forward or backward with the chin, unless a special operation is performed on the lower teeth to prevent the lower lip from changing its relations to the upper lip. The dento-facial relation of the lower lip from the commissure to the boundary which merges into the chin, is characterized by the position of the lower labial teeth and surrounding alveolar process. While it is comparatively easy to move the crowns of the lower incisors, an extensive bodily protruding or retruding movement of the roots will be found far more difficult than a bodily movement of the upper incisors. Fortunately, it is not so frequently demanded, for the same reason that the lower jaw and teeth are not so liable to be affected by local causes which so often interfere with the development of the upper jaw and the normal arrangement of the upper teeth.

Lower Retrusions or Class III

Types A and B, Class III. — It is true that we meet with many cases in practice in which there is a decided retrusion of the **lower apical zone,** involving the entire **labio-mental area,** in its relations to the chin, with an unhappy deepening of the depression which lies immediately over the roots and **incisive fossae.** In these cases, the lower lip in natural pose will be caught back of the upper teeth, or will be rolled downward with a deep crease beneath, that is frequently darkened by obstructed sweat glands. In its most pronounced form, this character of deformity is often mistaken for a protruded upper, on account of the antero-posterior malrelation of the upper and lower teeth. If, in these cases, the lower teeth are regular, in a perfectly formed arch, and the labial retrusion is due to the fact that the entire dental arch and alveolar process is too posteriorly placed in relation to the lower jaw, and with the lower buccal teeth in distal malinterdigitation with the upper, or Type B, Class III, an attempt to **wholly** correct the occlusion and facial imperfection by an extensive protruding movement of all the lower teeth would rarely be advisable for patients older than 12 years. Nor would such an extensive movement of the **lower labial** teeth alone be advisable, which would require to be retained by the insertion of artificial bicuspids. Therefore in cases older than 12 or 13 it would be excusable to obtain a part of the correction by a reciprocal retruding movement of the upper, even though the dento-facial area was left slightly depressed; thus choosing between this and the greater evil of leaving the lower teeth abnormally inclined with other probabilities that might follow.

If, however, the malocclusion is **due partly to protrusion** of the upper teeth, the application of the intermaxillary force will be indicated, to produce a reciprocal movement of all the upper and lower teeth to bring the buccal teeth into normal occlusion. In this protruding movement of the lowers, if the incisor teeth are forced into abnormal labial inclination, as they frequently will be when moved extensively with a single arch bow, the bow should be replaced with the **Contouring Apparatus 84,** and the intermaxillary force continued as before. If the lower labial retrusion is due to a malalignment of the teeth — which often is the case — and if the arch will be sustained by correcting this malalignment, a considerable movement of the roots, if demanded, would certainly be advisable. Again, if the lower labial retrusion is due — as it frequently is — to the injudicious extraction of one or two lower bicuspids or first molars, and the deformity and concomitant malocclusion is sufficient to demand correction, one should never hesitate to move the teeth forward to the position which Nature intended they should occupy, even if retention required the insertion of an artificial tooth or teeth to take the place of the lost one.

An appeal for a careful and intelligent diagnosis in differentiating between different types having similar characteristics cannot be too often enforced,

especially in reference to full disto-mesial malocclusions in which there is only a moderate protrusion of the upper. If the upper buccal teeth are in mesial malocclusion fully the width of a bicuspid or nearly so, in all probability the lower teeth may be more or less retruded. If the lower teeth are found to be really retruded in relation to the chin with an unesthetic deepening of the labio-mental depression, the case will belong in Class III, Types A and B, to be corrected partially or principally by a protruding movement of the lower teeth.

Type C, Class III. — But with this same occlusal malinterdigitation of the cusps, if the lower teeth are **not** retruded **in relation to the chin,** and the upper is no more than slightly protruded, it will indicate that the **lower jaw** is also retruded, or Type C, which at once bars the propriety of protruding the lower teeth in relation to the lower jaw, as the almost inevitable effect would be that of a receding chin. Nothing so forcibly robs the physiognomy of the desired expressions of manhood, intellectuality, and beauty as a receding chin. Therefore of the two evils it may be preferable in this contingency to retrude the upper teeth even more than otherwise would be demanded to fully correct the upper dento-facial outlines.

Type D, Class III. — If the case is one of **close bite malocclusion,** or Type D, with the lower incisors striking the gum or lingual ridge back of the upper teeth, special treatment calculated to relieve the occlusion and permit the retrusion of the uppers will be found under **Aps. 85 and 86.** Close bite malocclusion may be a complicating condition with any type of Class II or III, therefore it can hardly be considered, though placed as, a distinct type. Whenever it occurs, however, it is evident that the bite must first be opened, in order to permit a retruding movement of the upper or a protruding movement of the lower labial teeth.

Upper Retrusions or Class IV

Upon entering the field of **upper retrusions,** we come to a division of dento-facial irregularities that are nearly as frequent in occurrence as upper protrusions, and in their most marked types produce facial deformities that are quite as unpleasant in appearance. Like upper protrusions also, they present a number of important variations which demand a most careful and intelligent comparison of dental and facial relations to determine their real character and subsequent treatment.

In all marked cases, the upper incisors and sometimes all the labial teeth are inlocked in occlusion back of the lowers. Nor is this due to a lingual inclination of the teeth, as the roots and the entire alveolar process are frequently more retruded than the incisal zone, the upper apical dento-facial zone being abnormally depressed in proportion to the retruded position of its supporting framework. When the condition is due to a lack of development of the incisive alveolar process, the entire lower portion of the nose and upper lip will usually have the

appearance of having been pushed back into the face, with deepened naso-labial lines on either side. The end of the nose, being supported by the retruded nasal spine and cartilaginous septum, has usually a backward curve, the whole producing at times a startling expression of maturity when seen as it frequently may be with children from 10 to 12 years of age. See Fig. 47, p. 178. This deepening of the central features of the physiognomy will make the cheek-bones appear abnormally prominent and the lower jaws prognathous, for the same reason, in a reverse ratio, that a decided upper protrusion produces the effect of a retruded lower jaw.

For the last twelve years the author has repeatedly called attention to this fact in numerous papers, and he is pleased to see that there are now not so many attempts as formerly to retrude lower jaws with the occipital force, or protrude them with the operation of "jumping the bite." It is to be hoped that this is due to the fact that real conditions are recognized and treated, instead of effects.

Fig. 53.

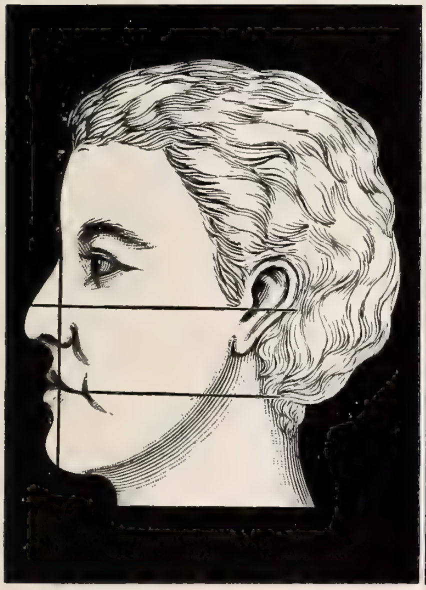


Fig. 54.

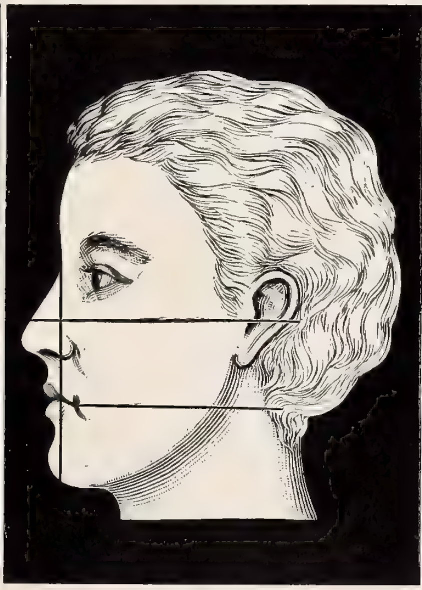
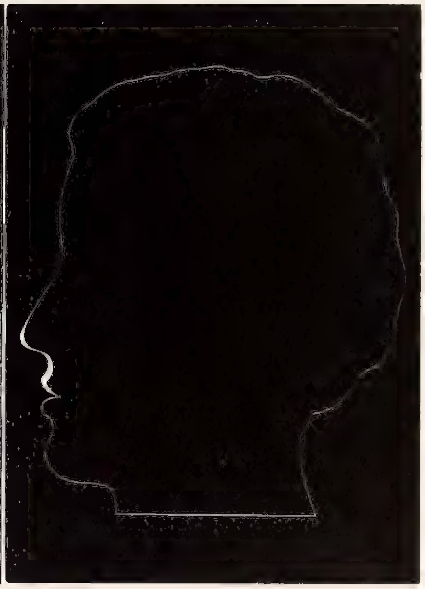


Fig. 55.



This principle is well illustrated in Figs. 53 and 54, which are drawn exactly alike in every particular, except a slight change in the profile outline of the upper lip and the end of the nose. The amount of the facial movement is shown in Fig. 55; which illustrates also how a very little depression of the central features of the physiognomy, shown in the first figure, will produce the effect of prognathism of the lower jaw. If the cross lines of these figures were removed, one would hardly believe that the harmonizing effect in Fig. 54 was not partly produced by retruding the outlines of the lower lip and chin, or that it has been accomplished with so little change as that shown in Fig. 55. This change is exactly that which may be accomplished in any case under 18 years of age, with force properly applied to the upper labial teeth.

Moderate Upper Retrusions.—One of the most common forms of facial imperfections that one meets in a study of physiognomies is a somewhat flattened face, with prominent cheek bones and lower lip. If the teeth were examined one would probably find if the upper incisors did not bite back of the lowers that the incisal edges were even, or but slightly overlapping, and that the roots and alveolar process were retruded.

Types A and B, Class IV.— In some instances, the entire upper denture and alveolar ridge is decidedly retruded in dento-facial relations and with the upper buccal teeth in distal malinterdigitation. See Fig. 34, p. 333. In others the buccal teeth are quite or nearly in normal occlusion and the cuspids forced into slight labio-buccal malalignment, the incisor teeth alone being retruded and inlocked back of the lowers. See Fig. 38, p. 340.

Types C and D, Class IV. — Again, the retrusion is frequently due to abnormal nasal obstructions and to a general lack of development and growth of the upper jaw, crowding the teeth into a malaligned contracted arch. In these cases the mouth-breathing necessity and habit will frequently cause an open bite malocclusion. See Figs. 40 and 43, pp. 342 and 345. Finally, but by no means least, the injudicious extraction of permanent teeth to prevent or correct a fancied threatened irregularity, is one of the most prolific causes of upper retrusions.

Further principles of diagnosis, and treatment of Class IV, will be found extensively described in specific methods of correction, Part V.

Lateral Contours

Facial areas which lie over the bicuspids and first molars, back of the dento-facial area, in Fig. 45, and separated from the lips by the naso-labial lines, may be considered as separate spheres of influence, as the causes which produce a change in the contour of the cheeks differ so decidedly from those which change the more centrally located areas. For instance, the lateral expansion and contraction of the dental arches will often change the contour of the cheeks with no special effect upon the labial area, providing the anterior teeth remain unchanged in position. Again, a decided retrusion of the front teeth and processes, with no lateral expansion of the arch, will invariably result in giving to the cheeks a fuller contour by relieving the tension of the muscular tissues. The same result will often be attained in closing the characteristic open bite of a mouth-breather by grinding the occlusal surfaces of the back teeth.

Other dento-facial irregularities which comprise the balance of classified types in this work are far more uncommon, and inasmuch as the different characters, which are quite unmistakable, are fully treated in other parts of the work, the author deems it unnecessary to mention them in this chapter.

CHAPTER XVI

CLASSIFICATION OF IRREGULARITIES

The teaching of Orthodontia has been especially difficult because of the almost limitless variety of malpositions which irregularities of the teeth present, and particularly because irregularities of the teeth have never been systematically nor scientifically grouped so that one could speak of them as belonging to a certain class, or type of a class, and convey an intelligent idea, without other qualification as to exactly what is meant; and thus enable one to at once differentiate the condition from types of other classes which have the same character of occlusion, and other misleading similarities.

In the author's opinion it is unscientific to place in one class malpositions which, though similar in occlusion, produce widely different facial deformities and consequently demand widely different methods of treatment.

In the classification presented in this work, there has been an endeavor to arrange the different classes of irregularity upon the basis: first, that **a class** should be a designation of a main characteristic, which differs in this particular from all other classes, and which may be recognized by the malrelations of the teeth and facial outlines; second, that each class should be divided into its distinct characters or **types,** which differ from all other types. With this arrangement, no doubt should arise in the minds of students as to the real character of irregularity that is presented for study or treatment. This being known, the general movement demanded for its correction will at once be apparent. But with irregularities of the teeth, like diseases in general, we find that a considerable number of the cases which present for treatment cannot be classified under this rule, because they individually are composed of such a variety of conditions they are neither one nor the other. I refer to conditions of malturned teeth, malalignments, intrusions, extrusions, contracted arches, etc.

In this work therefore irregularities are divided into **two** general **divisions.** In the **first division** are placed conditions that are not susceptible of classification. These are named **Simple and Complex Irregularities.** They are divided into six groups (See p. 194). In the second, or **classified division** are placed distinct types whose correction is dependent upon the effect they produce or are destined to produce upon the physiognomy. These are named **Dento-Facial Irregularities.** They are divided into seven classes (See p. 260).

In a majority of the cases of the **first division** the disto-mesial relations of the first molars are normal, or nearly so. This disto-mesial normality of the buccal teeth will also be found to obtain in a number of distinct types in the

second division or classified irregularities, and which decidedly differ from each other in the main malposition which characterizes them as distinct types. Therefore, if we place all this great variety of irregularities having a normal occlusion of the buccal teeth in one class — or "Class I," of Dr. Angle's classifications — because of their similarity in the single characteristic of normal disto-mesial occlusion of the first molars, would it not be quite as wise, so far as this suggests any idea of the real malposition or its treatment, to place them in one class because the teeth are irregular and demand correction? The latter will convey nearly as much information as the former as regards the character of the irregularity and its treatment. It also possesses the decided advantage of not being misleading.

It is not intended by this to undervalue an intelligent observation of the **occlusion** in order to know at the beginning of an operation whether the teeth are in normal occlusion or in lateral or disto-mesial malrelations in regard to the normal, because such malrelations often demand correction on the basis of the normal, like other malpositions; moreover, a knowledge of the character of the occlusion of the first molars is an important diagnostic sign to be intelligently considered with other important signs in determining the character of the irregularity and its treatment. But for one to say that an irregularity belongs in a certain class because of a certain relation or malrelation of the upper and lower buccal teeth to each other, and then upon that basis proceed to shift the teeth to a normal occlusion with the belief that when that is attained that the irregularity is corrected, is simply absurd.

When one has seen that the disto-mesial occlusion of the molars is normal in a certain irregularity, the knowledge gives no clue to the real character of the irregularity, which must **afterwards** be determined in order to know what to do.

The same is true of cases where the upper first molars in relation to the lower occlude mesially and distally to normal; which are Dr. Angle's second and third classes respectively. To show how impossible it is to determine the real character of an irregularity of the teeth as a guide to treatment, by the disto-mesial relations which the upper and lower buccal teeth bear to each other, one has but to intelligently note the many types of dento-facial inharmonies with a mesial malocclusion of the upper buccal teeth in relation to the lower in Classes II and III. Five of these types may be seen in Fig. 26, Chapter XII, all of which differ from each other in their real relations and treatment quite as much as they differ from other irregularities which have a different occlusion of the teeth.

If you had the dental casts of these cases for careful examination, you would say that they are quite like each other in all general relations; the same apparent protrusion of the uppers in relation to the lowers; the same disto-mesial relation of the first molars — the upper about the width of a bicuspid in front of a typically normal occlusion with the lower — and yet upon such a basis of diagnosis if you treated them all alike you would not be practicing intelligent dento-facial orthopedia.

It is not presumed that the marked facial characteristics of the several types will always be found in the pronounced forms of the cases shown in the several classes of dento-facial irregularities, but in all varying degrees, in proportion to the relations of the teeth to the unchangeable features of the physiognomy. In other words, the peculiar characteristics which constitute a class or a type may be found merging into that of another class or type, requiring an intelligent appreciation of the real condition and demands of treatment, which cannot be gauged by cut and dried rules. It seems, however, of eminent advantage, especially in our teaching, to have these division guide-posts of **class** and **type** characteristics, to work to or from, instead of placing distinctly different irregularities in one class because they happen to be alike in the single particular of buccal occlusion; especially as this tells us nothing of the real condition nor points the way to its correction.

Simple and Complex Irregularities, whose practical treatment is described in Part IV, includes by far the most common forms of dental malpositions, and while there is no case however apparently simple in which the type and peculiarities of the physiognomy should not be carefully and intelligently observed, this division is supposed to contain only those strictly dental irregularities that produce no marked facial imperfection, and which when properly corrected without extraction or loss of any of the teeth, will result in normal occlusion.

For teaching purposes, this division is divided into **six groups,** which represent the six common malpositions that may arise in connection with any irregularity. See p. 194. By segregating them, as the author has done, into separate groups, it will be possible to define with drawings or with lantern projections the different varieties of malposition which each group may assume and the most effective appliances and methods that are applicable for their correction.

In Dento-Facial Irregularities or the **classified division,** the malposition is distinctively characteristic of the class, or one of its variations, and while it may contain minor complications, the principal methods that are applicable for the different types will be about the same in every case. See p. 260. With the exception of Class I, this division is divided according to the peculiar facial deformity or imperfection which the irregularity produces; and even with Class I, diagnosis with a view to treatment is dependent solely upon an intelligent consideration of the relations of the teeth to the physiognomy and the harmonizing influences of maxillary and facial development.

At the meeting of the Institute of Dental Pedagogics in 1903, the author presented a classification which divided dento-facial irregularities into fourteen classes, which were exactly in accord with the different distinct characters of dental and facial abnormalities which malpositions of the teeth and jaws produce, and which consequently indicated the line of treatment demanded for their correction. Believing it might simplify the processes of teaching to group together under class headings the different types that are similar in their

general aspects, the number of classes which are now presented in this work are reduced to seven. A number of characters which were described in the first classification as constituting separate classes now appear as **types** of other classes.

In **Class I** is now placed every type which is characterized by a **Maleruption of the Cuspids.** In **Class II,** every type of **Upper Protrusions with lower normal.** In **Class III,** every type of **Lower Retrusions** with **upper normal** and **upper protruded.** In **Class IV,** every type of **Upper Retrusions** with **lower normal** and **lower protruded. Lower Retrusions,** which were formerly placed in a separate class, are now placed as **types** of Class IV, because they are so frequently complicated with **Upper Retrusions.** These four classes compose the principal dento-facial irregularities met with in practice. The three additional classes, which remain as before, are far more rare; in fact, few writers upon Orthodontia mention them as distinct types, though in every one of these three classes of dento-facial deformities are found the most marked and difficult characters to correct. Inasmuch as each produces a distinctive type of facial outlines that is peculiar to the class, they very properly are placed, in this work, as an important part of classified irregularities with the hope that they may be recognized and differentiated from other forms which are similar in occlusion, and treated according to their dento-facial demands.

Even marked types of **Bimaxillary Protrusions** (Class V) are not so very uncommon in the author's practice (See Fig. 24, p. 135); indeed, the lesser types of this class are seen everywhere, though not usually recognized as belonging to conditions which demand treatment, but rather as inherited expressions of the physiognomy which create no thought of the possibilities of remedy, and particularly because the teeth are in normal occlusion.

Lower Protrusions are now placed as types of **Class IV** because in practice and teaching it is so difficult to extricate the various types of this class from **upper retrusions** or some form of upper irregularity with which it is complicated.

If the different distinct types of irregularity of the teeth which are shown in the various classes arise in practice, and if it is true that the occlusal relation of the buccal teeth is an unreliable and often misleading guide to the real character of the irregularity and its treatment, why classify them at all, if not upon some basis that will appeal to the needs of teaching and practice? By bringing together the same conditions which dentists have been treating since the practice of Orthodontia began, and by separating them so as to place in each class a definite type, or series of types which demand for their correction quite dissimilar movements, we have endeavored to present a classification that will enable us to recognize these conditions and more clearly define, teach, and practice orthopedic dentistry according to correct principles of applied science and art.

PART IV

Practical Treatment of Simple and Complex Malpositions

TABLE OF GROUPS

SIMPLE AND COMPLEX IRREGULARITIES

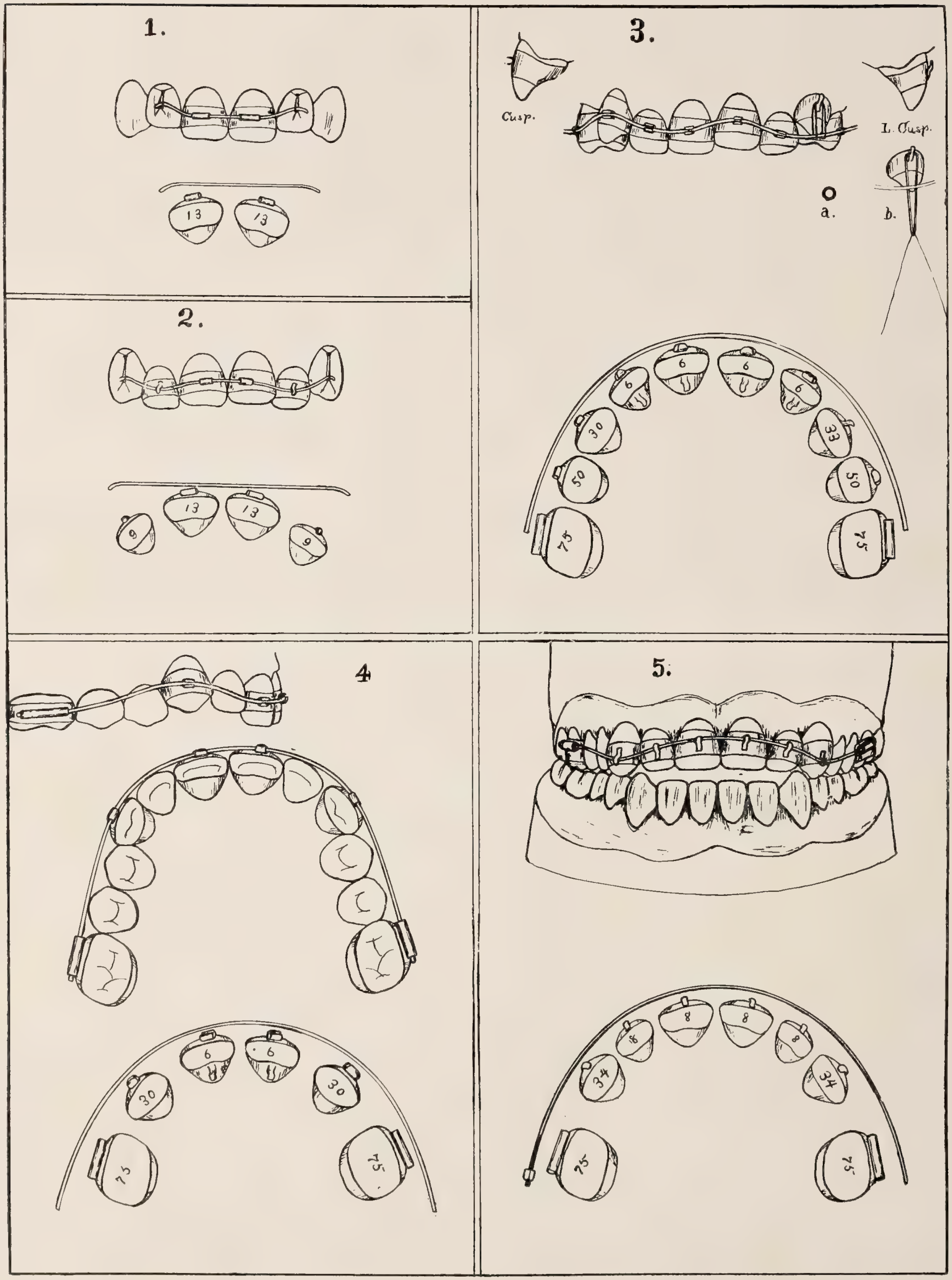
INTRODUCTORY

The particular characters of irregularity which are presented in the following drawings of apparatus for **Simple and Complex Irregularities** have been diagrammatically chosen to represent the most common of the unclassified characters found in practice. It will be observed, however, that the particular malpositions of the cases are only those which belong to the group in which they are placed; whereas in practice it is common to find in one case a number of the malpositions that are represented in two or more of the groups. And while many of the drawings are quite similar to cases in practice, the main object of the author in segregating the different malpositions in this way, is to show under one group the most effective appliances and methods which may be employed for the correction of every distinct variation of each character of malposition.

It will be found that the different methods in the several groups may be combined so as to cover a variety of malpositions in one case by selecting bands with the proper attachments, for the motive appliances, which will exert the appropriate forces for the correction of the entire irregularity of the case in hand.

The various **Groups and Classes** are introduced with a general description of the special character of the irregularity considered, differential diagnosis, needs and methods of movement, etc. The drawings are designed to conspicuously show: First, the dental character of the irregularity under consideration, and when important the occlusion and facial effect that is peculiar to the case; Second, every necessary view of the apparatus in position on the teeth, and with special parts in detail; Third, the apparatus disassembled from the teeth and shown in its various parts: the whole, calculated to render every aid for its correct construction. With this mainly in view there has been no attempt at anatomical or artistic effect, the principle object being to distinctly show the character of the irregularity and the appliances, or complete apparatus, which the author has successfully used in his practice for its correction.

Accompanying the illustrations will be found a concise description of the form of the irregularity treated; the movement demanded for its correction; the apparatus in detail, with the gauge sizes of its several parts; the special force it is calculated to exert; methods of construction; assembling; adjustment, etc.


1.
13
13
2.
13
13
9
9
3.
Cusp.
L. Cusp.
a.
b.
6
6
6
6
30
33
50
50
75
75
4
6
6
30
30
75
75
5.
8
8
8
8
34
34
75
75

CHAPTER XVII

GROUP I. INTRUSION AND EXTRUSION

When one or more teeth are above or below the normal occlusal plane they are in the malposition of **Intrusion** or **Extrusion**. If, however, one or the other of these conditions involves all the front teeth, they are then in the malposition of **close bite** or **open bite malocclusion**. See **Aps. 88 and 89.**

Extensive **intrusions** of the front teeth are not infrequently due to traumatic causes. In several youthful cases in practice the central incisors were driven into their sockets nearly out of sight. If treated soon after the injury these cases should always be corrected by immediate surgical regulation, especially at the age when the roots are liable to be undeveloped.

Simple **intrusion** and **extrusion** of one or more front teeth are commonly caused by some interruption in the processes of secondary dentition. Occasionally these conditions are caused by the attempt to retrude all the front teeth with a traction or alignment bow from a molar anchorage. The teeth thus being crowded one upon the other against convex contact surfaces and not permitted by the alignment bow to overlap each other are often forced to slide up or down in relation to the normal occlusal plane. An overlapping or malaligned irregularity, or the loss of a tooth in one jaw with a concomitant contraction of the arch, will tend to crowd the teeth of the opposing jaw, through the influences of occlusion, into an equally contracted arch. This frequently forces them out of alignment, causing them to overlap or rotate, and occasionally it produces an intrusion or extrusion of one or more teeth.

Apparatus 1

A simple method of **extruding** the laterals and **intruding** the centrals is shown in **Ap. 1.** Bands are cemented to the centrals with rotating tube attachments, through which a No. 22 or 23 resilient wire is passed. This is cut the proper length, and its ends given an occlusal curve to prevent the ligatures from slipping off. To the necks of the laterals tie Corticelli Twist D, the ends of which are then tied to the wire so as to exert an extruding force as shown in the drawing. If only one lateral is intruded, the bands are cemented to the central and cuspid and the ligature tied on the wire between. See **Aps. 41 and 42.**

Apparatus 2

This is an extension of the same principle for **extruding the cuspids and centrals,** and **intruding** the **laterals.** For extruding the laterals, as in the former case, or

the cuspids in this case, bands with gingival hooks or open-tube attachments might be found preferable to the ligatures.

Apparatus 3

Where the **cuspids** are **intruded** or do not fully erupt on account of the somewhat crowded condition of the teeth, it is usually advisable to use a No. 23 or 22 resilient alignment bow from molar anchorages. Thin open-tube attachments properly placed to exert the desired force, as shown in the drawing, admit of an easy assembling of the apparatus and when the tubes are closed leave a comfortable finish. The bands shown in the drawing carry also lingual hooks for rotating, etc., with silk or wire ligatures. Instead of the hooks, the Angle pinhead attachment (**B. 7½**) may be preferred.

One of the principal objects of this apparatus is to **extrude the cuspids.** With that in view the bicuspids should be banded with open-tube or hook attachments in order to impart the proper degree of force to the bow. When the cuspids are considerably intruded with diminished opportunities to firmly attach the bands, a favorable method, as shown, is to extrude them with rubber ligatures from gingival hook attachments. The force of the bow if sprung far out of line and directly clasped in open-tube or hook attachments — as shown on the right cuspid — would tend to dislodge a weakly attached band.

A cuspid with only a portion of its labial face exposed can always be banded without much difficulty (See p. 41, Chap. IV), and with sufficient firmness of attachment to support a rubber ligature, which is generally sufficient in this stage of its movement.

In assembling all appliances intended to exert extruding force, the cement of the bands should be allowed to become perfectly hard before the force is applied. If it is thought best to delay the placing of the alignment bow until the next day or later, the open-tube attachments, etc., should be covered with gutta-percha or Hill's Stopping to prevent their sharp edges from irritating the tissues.

Apparatus 4

This apparatus shows the treatment of a very common form of irregularity which may be considered the simplest of that most common malposition which is characterized by **maleruption of the cuspids.** See Class I. It is placed in this group because a simple resilient alignment bow, No. 22 as shown, will commonly correct it with little attention. The effort of Nature to erupt crowded cuspids will at times extrude the centrals. Should all of the incisors demand a slight protruding movement to enlarge the arch and give more room for the cuspids, the laterals can also be banded with open-tube attachments. If this condition is somewhat marked, it may be necessary to use a heavier arch bow threaded for nuts at the mesial ends of the molar tubes. Again if the bicuspids have been

forced into lingual malalignment, or if the bicuspid area demands a slight expansion, additional appliances will be indicated.

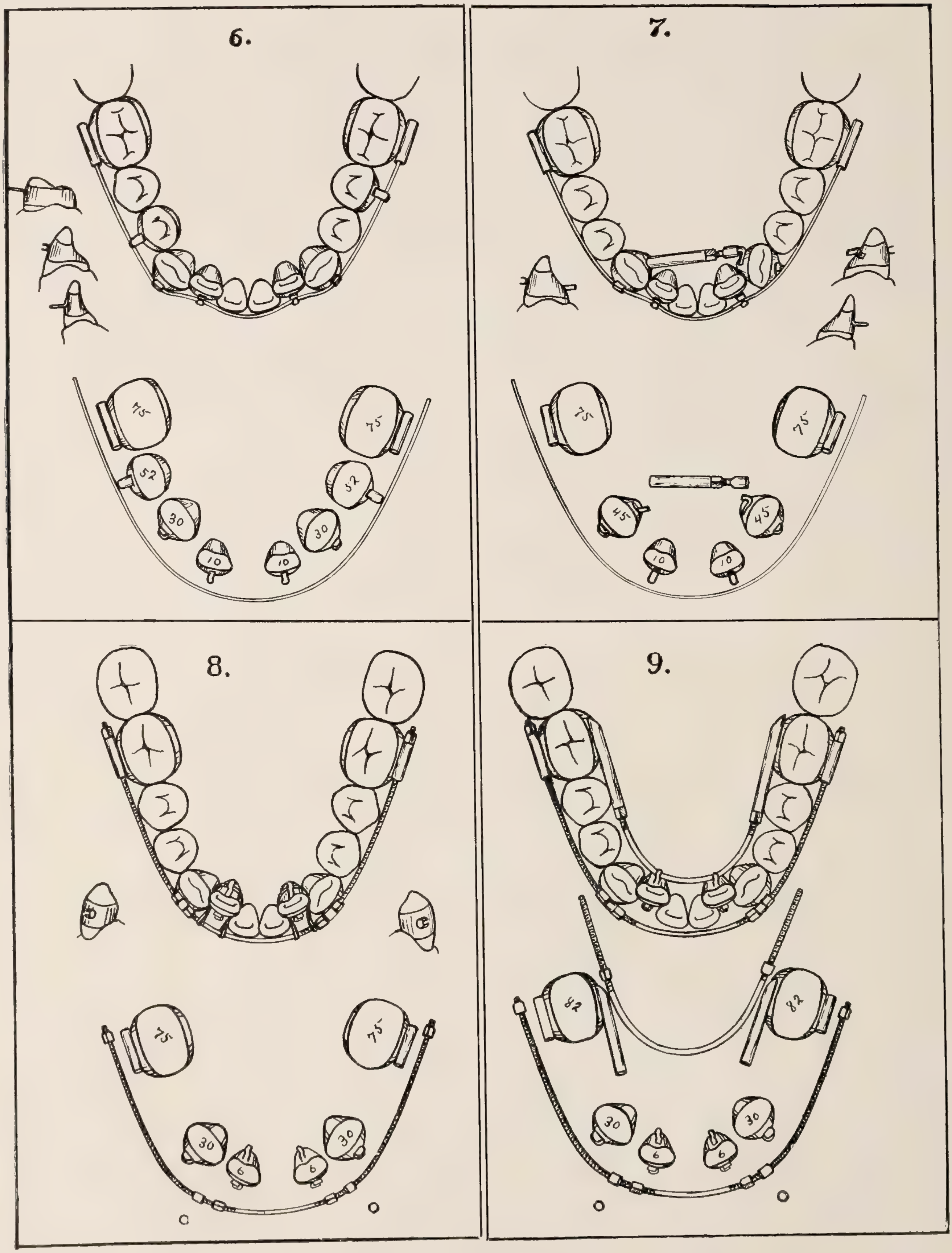
This apparatus is applicable only to those cases in which the cuspids demand slight movement and little artificial aid. For the application of greater force see Class I. In this connection it should always be remembered that in the common course of secondary dentition, the cuspids are often naturally crowded out of their normal alignments; and when the direct cause of this amounts to no more than a slight constriction of the space required, for young patients, Nature will usually correct the malposition by the natural growth of the jaw.

Apparatus 5

The intention of this drawing is to show a **uniform intrusion** of the **upper incisors** and an **extrusion** of the **cuspids,** but it being made with the occluding teeth slightly apart, it has the appearance of an ordinary open-bite irregularity.

The condition intended to be illustrated can be usually corrected with a resilient alignment bow No. 20. Open-tube attachments, or hooks as shown, can be used on the labial teeth. The labial attachments should be so placed in relation to the position and spring of the bow that a pressure in proportion to their needs will be exerted. Should it be found that this is not maintained, the wire may be bent with the **step pliers** (See p. 102). If at first the teeth are unevenly intruded, the attachments should be placed so as to correct the alignment. In all cases where exactness in the position of an attachment is necessary, the bands should be perfectly fitted on the natural teeth before the attachments are soldered, and the desired positions marked on the bands with a sharp-pointed instrument. If, however, it is discovered that the bow is exerting an undesired extrusion or intrusion of certain teeth, it can always be lowered or raised with the **step pliers** at the point where it engages with the attachment.

If one or more of the teeth are turned, the bands should carry the proper attachments for rotating them. After the bow has been given the proper arch curve (See p. 196), place the ends in the anchorage tubes and cuspid attachments, and then spring it up into the incisor attachments. When the cuspids are in normal occlusal position, if used as fulcrums, this force will abnormally intrude them; in which case rubber bands extending from the upper to a bow attached to the lower teeth may be indicated, or the force upon the cuspids may be relieved by distributing it to the bicuspids.


6.
75
75
52
52
30
30
10
10
7.
75
75
45
45
10
10
8.
75
75
30
30
6
6
9.
82
82
30
30
6
6

CHAPTER XVIII

GROUP II. MALALIGNMENTS AND CROWDED COMPLICATIONS

When one or more teeth occlude lingually or labially or buccally to the normal line of the arch, they are in the malposition of **malalignment.**

Commonly the teeth are so crowded in the arch that the malaligned teeth cannot regain their normal pose without the aid of artificial force. When a dental arch — especially the upper — is deprived of its natural arch support, through the loss or maleruption or malalignment of one or more labial teeth, the influences of muscular action alone will tend to contract its natural boundaries. The contraction of a dental arch in this manner will often cause the opposing arch to become also contracted and the incisors malposed through the forceful influences of occlusion and muscular action.

The origin of a large proportion of all complex irregularities, be they simple or complicated, may be traced to the premature loss — usually from extraction — of the temporary teeth, followed by a maleruption of the succeeding teeth.

It would seem hardly possible, though true, that the contracting action of the muscles of lips and cheeks could decidedly enhance and even produce a complicated irregularity which may have started through the maleruption, injudicious extraction, or careless loss of a single tooth.

In the contemplation of correction, with a view to permanent retention, the teeth of the opposing jaw therefore will frequently require regulating to readjust the occlusion. In the preliminary examination and diagnosis of the more complicated cases, the character of **occlusion** of the **first permanent molars** is of the greatest importance. And in all cases where there is not that decided protrusion of one denture, or the other, that demands the extraction of bicuspids, *the teeth should be invariably placed in normal occlusion.* The apparatus should therefore be constructed for the application of forces which will not only laterally expand the arch or arches to normal bucco-lingual relations, but also to normal disto-mesial relations.

In malalignments of the upper, the mesio-buccal cusp of the first molars will commonly be found riding too much upon the mesio-buccal cusp of the first lower molars. It will be observed that this forward shifting of the upper molars, which was started by the premature loss of deciduous teeth, will tend, through occlusal forces, to drive the lower molars forward, producing either malalignment of the lower teeth or a proportionate protrusion of the entire denture. Too much stress therefore, cannot be laid upon the advisability of intelligently determining the effect which the teeth are destined to have upon the facial outlines, and in deciding

whether the occipital or the intermaxillary force is the more applicable for correcting the occlusion.

If the mesial malocclusion of the upper molars is greater than will be possible to correct by a slight distal movement, which may be brought about by a reaction of the alignment forces of the upper apparatus, provision should be made for the application of the **intermaxillary force**, remembering that the reciprocal action of this force will tend toward a mesial movement of the lower. If this is not advisable it should be prevented. (See chapter on the application of the intermaxillary force.) It may be that only the occipital force should be employed as an auxiliary.

Apparatus 6

When the **malalignment** is **slight** and in the position shown by the drawing, a resilient alignment bow No. 22 will usually correct the irregularity with the requirement of few if any subsequent adjustments. After the bands are cemented, curve the bow over the ball of the thumb to the form of the arch and place it in the molar tubes and cuspid rests and then spring it into its attachments on the contruded teeth, bending the hooks closely against the teeth.

When there is a greater lingual malalignment of one or more of the teeth, it may not be possible or advisable to force the bow to immediate contact with the tooth in the clasp of an open-tube or ordinary hook attachment; in which case it may at first be attached to the bow with a rubber, silk, or wire ligature, which would be especially applicable if the tooth requires rotating; otherwise, **band 52,** as shown on the bicuspids, with the **Matteson attachment,** is far preferable. See also **Ap. 21.** Too much praise cannot be given to Dr. A. E. Matteson of Chicago for this remarkably effective attachment for pulling contruded or extruded teeth toward an alignment bow. They are far superior to wire ligatures in all cases where a direct force is desired, in that they make no demand upon the interproximate spaces. Their treatment adjustments are simple, with no liability of breakages with painful renewals, and — what is very important — they present no irritating projections to the sensitive tissues. In its first adjustment the extreme end of the attachment is bent in the form of a hook around the bow so as to exert a moderate stress upon the tooth. At subsequent sittings the force is gradually increased by rolling its grasp around the bow with flat-nosed pliers.

Apparatus 7

The space for the lower incisors is frequently crowded in upon by the **contrusion of the cuspids,** caused usually by occlusion, and requiring the concurrent regulation of the opposing teeth. The drawing shows the application of a small pin-rest jack No. 19, attached to cuspid **bands 45** for expanding the labial arch. It also shows how to place the jack, in case one or both teeth are malturned and require rotating.

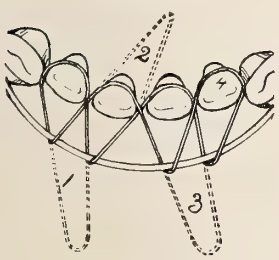
Apparatus 8

Expanding Arch Bow.—A novel and useful appliance for **expanding the labial arch,** from the labial aspect, is here shown. An alignment bow, No. 19 or 18, is threaded as shown with nuts exerting a distal force against the cuspid open-tube attachments. The short sliding intervening tubes are to permit turning the nuts. The distal nuts on the molars are for the purpose of controlling and regulating the cuspid movement. Care should be observed in tightening these nuts to avoid forcing the bicuspids out of the line.

Should bicuspid space be required, mesial nuts may be placed at the molar tubes and distal nuts at the cuspids. With a No. 18 bow and with the Matteson attachments on contruded bicuspids and incisors, this combination will enable the operator to symmetrically enlarge the entire arch or any buccal or labial segment of it. The incisor bands shown in the drawing are for the rubber, wire, or silk ligatures. It usually requires little force to move teeth into line as soon as space is obtained.

A very effective method of moving the lower incisors forward to an alignment bow, is with rubber ligatures, the practical application of which is shown in Fig. 1. The largest size of the Ash & Sons elastic rings is usually preferable for the four incisors. It is easily placed if attached to a loop of floss silk. Pass the ring under the bow and over a lateral and draw it forward (1); then over the bow and central (2). One strand of the loop is now made to pass around the right central and the other around the left, drawing the ring forward under the bow (3), which is finally carried over the bow to the lateral (4).

Fig. 1.

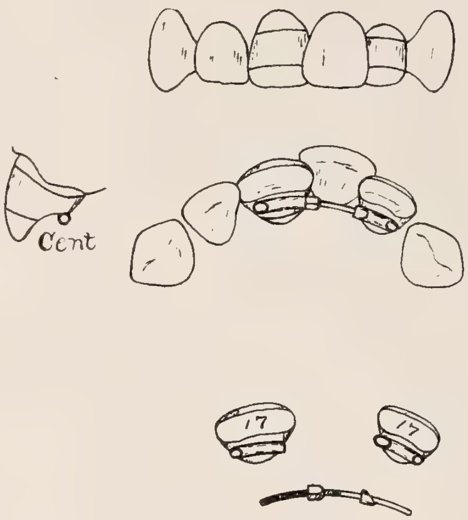


Apparatus 9

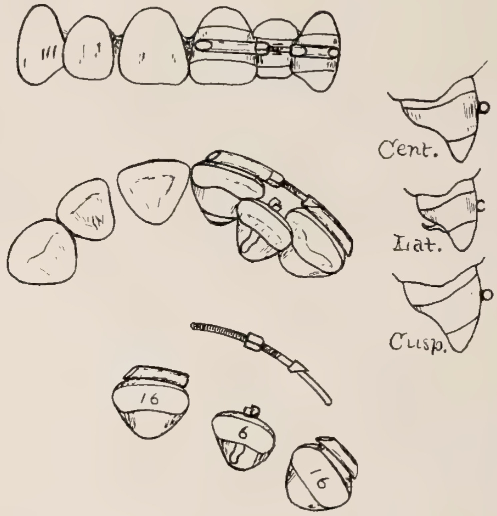
Expanding Bows.—This is the same as **Ap. 8** with the addition of a **lingual bow** for exerting a greater force upon the incisors. See **Ap. 15.** It is also useful for expanding the molar region.

In assembling lingual bows with long tube rests, both molar bands carrying the bow attached can be cemented at the same time, or one molar band carrying the bow can be cemented first, and then the other, by slipping the tube over the free end of the bow before carrying the band to place on the molar. With lower bows the latter movement is more applicable on account of the difficulties in controlling the saliva during the operation. A preliminary trial assembling should always be made before cementing. The position of the hooks and other attachments of front bands will indicate whether they are to be placed and cemented before or after the placing of lingual bows.

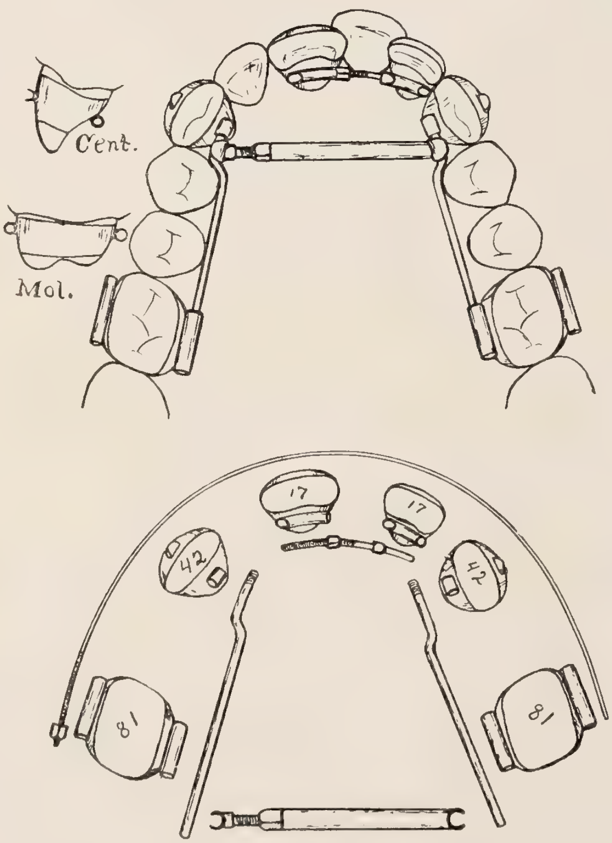
10.


Cent
17
17

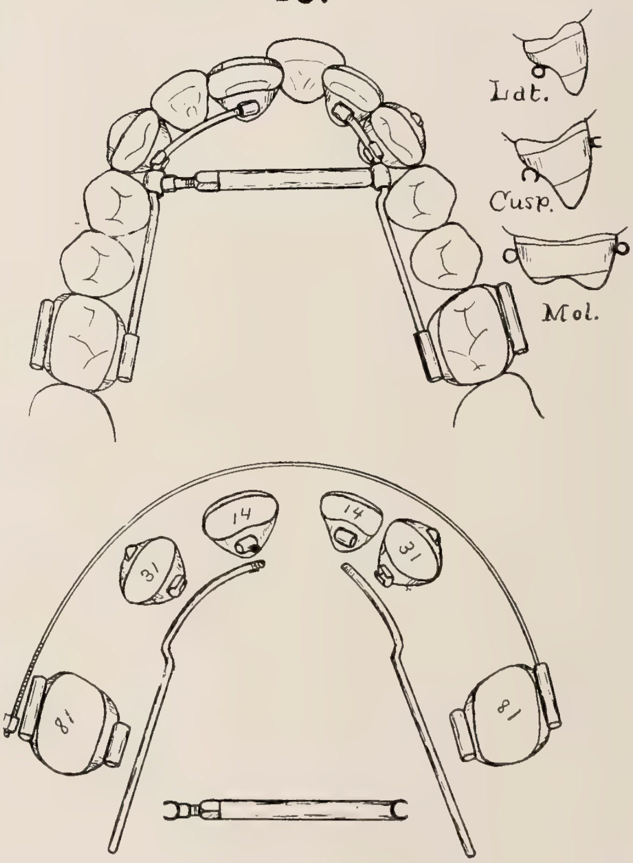
11.


Cent.
Lat.
Cusp.
16
6
16

12


Cent.
Mol.
17
17
42
42

13.


Lat.
Cusp.
Mol.
14
14
31
31

Apparatus 10 and 11

Curved push bars, with ends resting in curved tube attachments upon the lingual and labial aspects of front teeth, are admirably calculated for opening labial spaces for the alignment of one or two intervening teeth. A No. 18 or 19 bar is threaded at one end for a small hexagonal nut to engage with one of the tubes. A lug-tube, cut diagonally at one end is soft-soldered to the bar to engage with a diagonal cut end of the other tube and to prevent the bar rotating when the nut is turned. In assembling the appliance, the two bands (**B. 16**), with the bar curved and in position, are cemented and placed together. When sufficient space is obtained, the malposed tooth may be drawn to place with a rubber or wire ligature attached to the bar.

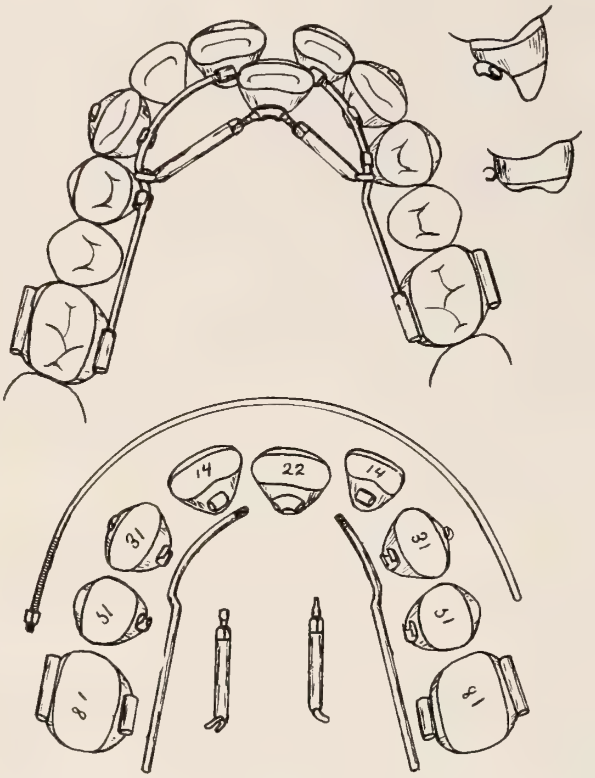
Apparatus 12

In all cases where the **arch** has become **contracted** because of the malposition of the incisors, it will demand a lateral expansion in order to place the teeth in alignment; moreover this movement of one denture will often demand the concomitant expansion of the other, else the uncorrected arch will force the other back to its former fixed occlusion. **Apparatus 12** shows a common method of expanding the anterior arch as an auxiliary to the labial or lingual curved push bars. The lingual bars No. 18 for distributing the force are threaded at their extreme mesial ends to screw into short threaded lingual tube attachments on the cuspids. The principal object of this method of attachment is to preserve the rigidity of the bars which would not be possible if hard-soldered directly to the bands. Though, if preferred, plain bars may be soft-soldered into short plain tube attachments. The distributing bars are bent to pass the bicuspids and to afford means of attachment to the bar rest expanding-jack. The buccal molar tubes and cuspid open-tube attachments provide means for an alignment bow, if needed.

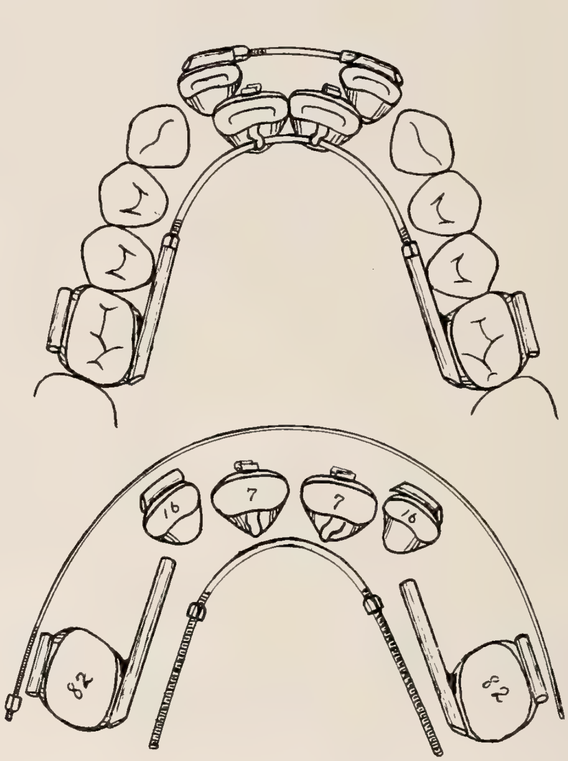
Apparatus 13

In those cases where the dental arches are not complicated with a variety of malpositions, the apparatus may be simplified as shown in the drawing under this head which does away with the need of the special labial appliances. The No. 18 distributing bars screw into threaded tube attachments on the incisors and rest in open-tube cuspid attachments. Again, in those cases where the front teeth are not greatly malposed, they can be usually brought to alignment by the aid of an alignment bow with ligatures, etc., after the arches have been sufficiently expanded with the expanding appliance shown in **Ap. 12,** without the curved bar appliance. In all cases of malalignments with crowded arches, the **foundation principle** of correction lies in first making room for the malposed teeth in the arch, after which the balance of the operation is comparatively easy.

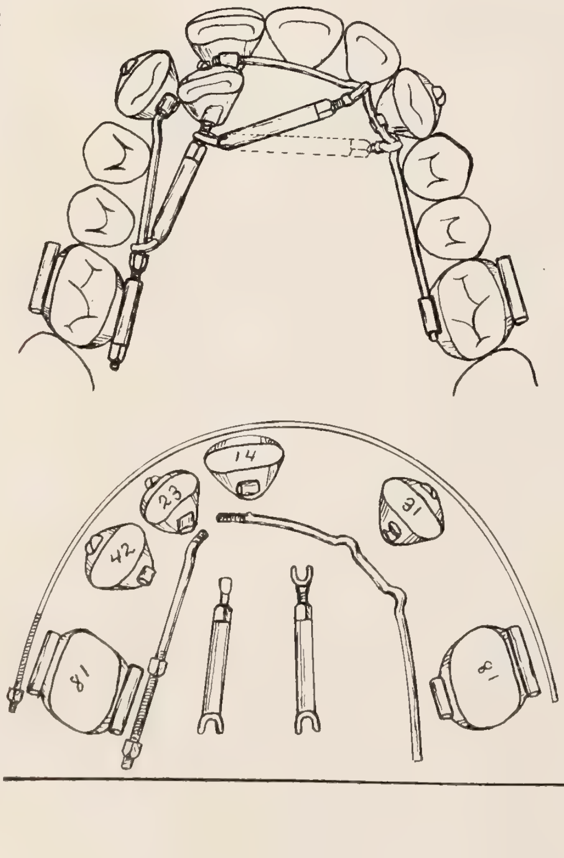
14.


14
22
14
31
31
51
51
81
81

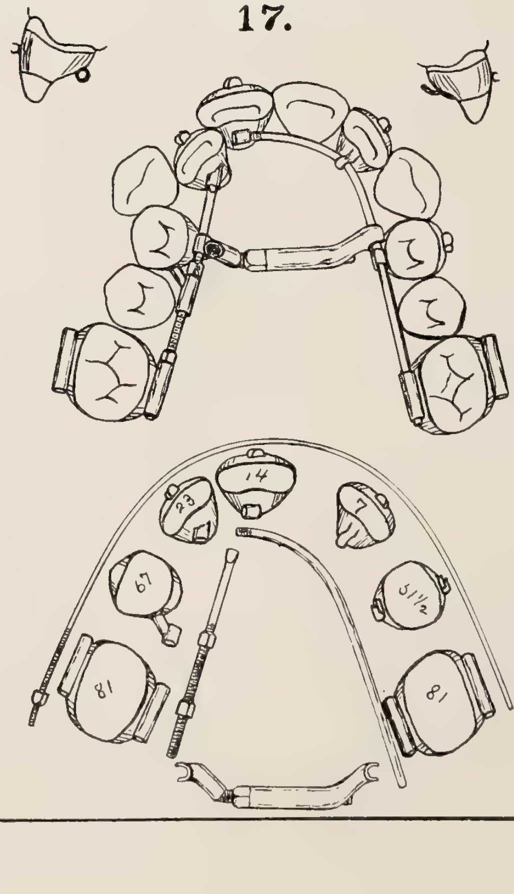
15.


16
7
7
16
82
82

16.


14
23
31
42
81
81

17.


14
23
7
67
31½
81
81

Apparatus 14

Fork-end Jacks. — In **contracted arches,** a single incisor is not uncommonly in lingual malalignment and sometimes inlocked in occlusion with the lower teeth; and though this irregularity will frequently seem to patients who apply for treatment to be very slight, as it appears to them to involve only one tooth, it in reality may demand the lateral expansion of both the upper and lower arches to insure permanency of retention. Through the motive force of the use of two small No. 19 jacks, as shown in **Ap. 14,** the arch is expanded and the tooth forced to alignment.

In assembling this apparatus, the incisor bands, with the lingual distributing bars shaped as shown and screwed into their attachments, should be cemented first, and then the molar bands. In placing the latter, first slip the lingual tube on the distal end of the bar and then with a hinge movement carry the band over on to the tooth. The cuspid and bicuspid bands may be placed before or after the lingual tube attachments are opened. If placed afterwards, the open tube is first placed on the bar in its respective position, and then with a hinge movement, as with the molar bands, it is carried to its position on the tooth. The open tubes should be finally closed around and burnished smoothly to the bars so as to offer no irritating edges to the tongue. The central band is then cemented and the jacks placed.

As before stated, all complicated appliances should be preliminarily assembled before cementing, to see that all the parts are correctly placed and as a guide to the final cementing of the apparatus.

In times long past,— let us hope,— it was believed to be necessary in the correction of **inlocked** upper front teeth to prevent them from occluding during the passage of the tooth or teeth over the lower incisal line. This was usually accomplished with interdental plates. With modern methods, applying positive forces, interdental provisions are now never required, even where all the labial teeth are decidedly inlocked, for the reason that the moving teeth are held firmly in the positions gained, and patients let them alone during their passage, finding other positions through the mobility of the lower jaw, sufficient for masticating purposes during the short time of interference.

In all of these cases the alignment bow is usually indispensable, as the protruding force exerted upon the malposed teeth or tooth will tend to force adjoining teeth out of alignment. Care should always be observed, however, to loosen the nut of the alignment bow to permit the proper expansion of the arch. With the apparatus in question, it will be observed that the expanding jacks exert a certain amount of distal force upon the lingual distributing bars, which will tend to retrude the front teeth and close interproximate labio-buccal spaces. Should this space be very wide as in Type A, Class II, with a narrowing of the upper arch, which might arise from thumb sucking, or close bite malocclusion, the

Fig. 2.

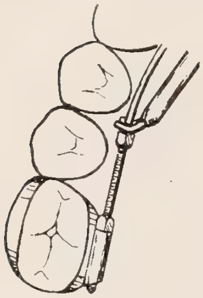


Fig. 3.

lingual bars can be threaded at their distal ends and rest in stationary anchorage tubes with distal retruding nuts.

In **crowded** and **malaligned cases** for which this apparatus is particularly intended, if it is found that the upper molars have drifted forward to a partial mesial malocclusion, nuts should be placed at the mesial ends of the single molar tubes so that the retruding force may be made to act directly upon the molars. If it is desired that the retruding force be exerted upon the molars with a view to their greatest distal movement in order to avoid the necessity of so much lateral expansion, the distal ends of the jacks may rest further back upon the bars, engaging with an extra nut as shown in Fig. 2, or with a sliding tube as in Fig. 3. These combinations are particularly applicable in maleruptions of the cuspids. See Class I.

In a general distal movement of the buccal teeth to correct the disto-mesial relations of malocclusion, the intermaxillary and occipital forces are invaluable, and may be applied directly to any of the buccal teeth as described in **Ap. 77** and in other places. The fork end jack-tubes for grasping a wire at any angle, are indispensable for this and many other purposes. The double jack rest attachment (B. 22) upon the malaligned incisor is very useful and not difficult to construct. See p. 206.

Apparatus 15

The two central incisors are frequently inlocked in occlusion with the lowers, while the laterals are mesio-labially malposed. The curved push bar, No. 20, assisted by the alignment bow, No. 20, will force the laterals to position and make room for the centrals, which in turn are forced forward by the lingual protruding bow, No. 18. The long lingual tubes firmly attached to the molar bands, into which the distal ends of the lingual bow are received, enforce the stationary quality of the anchorages. In those cases where more incisive space is required and when the bicuspid area demands expansion, **Ap. 14** with slight variations will be found more applicable. In assembling this apparatus see directions under **Ap. 14**.

Apparatus 16

With a decided **lingual malalignment** of a lateral incisor, the centrals are commonly inclined towards the space, and the mesial contact points sliding upon each other are carried to that side of the median line. In **Ap. 16,** the left lingual distributing bar, No. 18, is attached to the right central to engage with the right lateral through the medium of the expanding jack, with the view of correcting the drift of the front teeth towards the right. The jack can be changed to different positions by bending the bar as shown, at the interproximate

points. On the right side, the lingual bar, No. 18, attached to the cuspid in combination with the jack to the lateral incisor, exerts reciprocating forces for retruding the cuspid and protruding the lateral. As an auxiliary to the retruding force, the bar passing through a molar anchorage tube with a distal nut will enable the operator at any time to transfer the force to the molar. If the irregularity is exactly the same as the drawing, which demands a distal movement of the cuspid, commence with this force, and use the lateral jack only to reinforce the anchorage until there is more space for the lateral incisor. The alignment bow should not be placed until needed later in the operation.

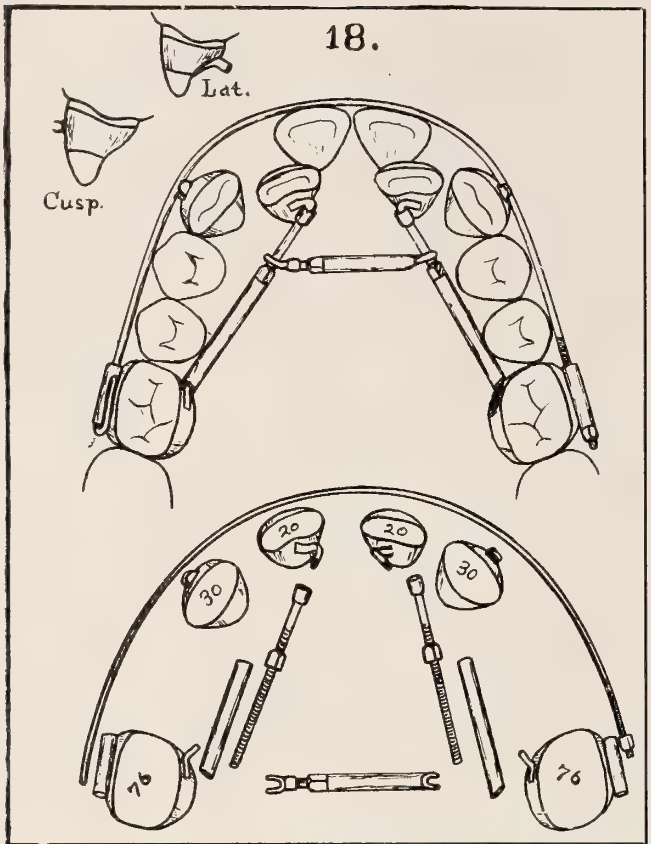
Apparatus 17

Drop Jack.—In the irregularity shown by the drawing, the right **bicuspid** and **lateral** incisor are decidedly **contruded,** in consequence of which the entire arch — excepting the cuspids — is contracted. The left lingual distributing bar, No. 18, is attached to the right central as in the former case, for the purpose of carrying all of the teeth within its grasp to the left. In the combination with the right bar, No. 18, the distally reacting force from the lateral incisor can be received either upon the bicuspid or the molar, it being desired to retrude these teeth to open the space for the cuspid in the general enlargement of the arch. The bicuspid attachment is peculiarly adapted for producing the greatest amount of inclination movement in proportion to the force exerted. (**See B. 67.**) It will be seen also in this combination as in **Ap. 16,** that the retruding force may be transferred at any time from the bicuspid to the molar. With this apparatus is introduced the **drop expanding jack,** which is especially valuable in the lateral expansion of the upper arch where interference with the tongue should be relieved as much as possible.

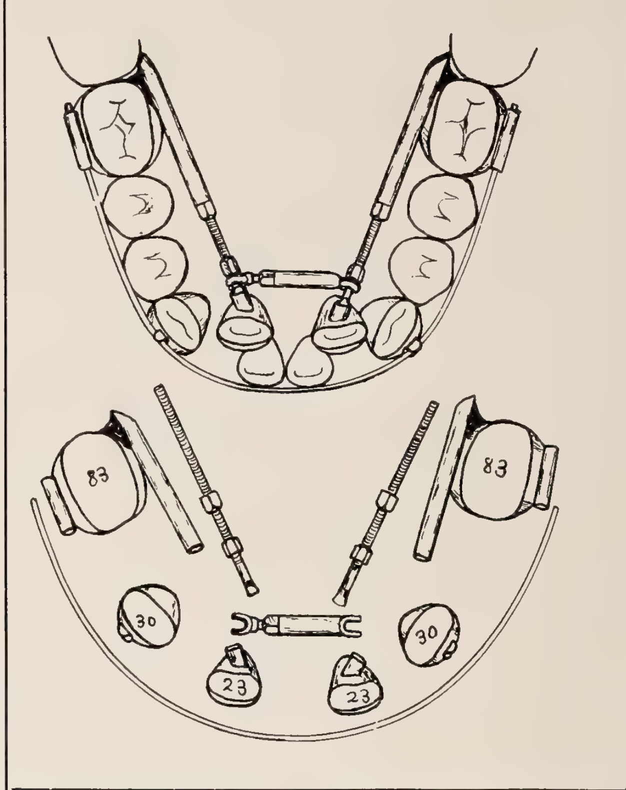
Apparatus 18

The **lingual malalignment** of lateral incisors is a common irregularity of both the upper and lower teeth. Premature loss — commonly from injudicious extraction — of the deciduous laterals is the frequent forerunner of this malposition. The early eruption of the permanent incisors, which are disproportionate in size to the surrounding parts and growth development, often obliges these teeth to, at first, take malpositions, the most frequent of which is a lingual malalignment of the laterals, more common with the lower laterals than with the upper. The early crowded malpositions of the lower incisors, if not too extensive, will usually be corrected through the natural force of development. Unfortunately it too frequently leads to the injudicious extraction of the deciduous cuspids and the production of that most common irregularity in Class I. When the upper laterals are inlocked in occlusion with the lower incisors, their correction is best accomplished with the positive force of screw jacks, in combination with an apparatus that is so constructed to nullify, or on the other hand, to utilize the force

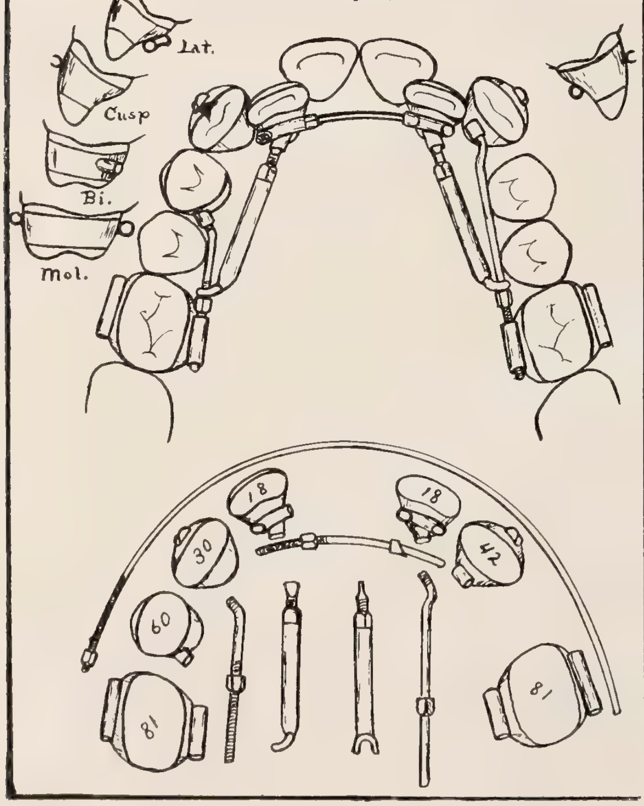
18.


Lat.
Cusp.
20
20
30
30
76
76

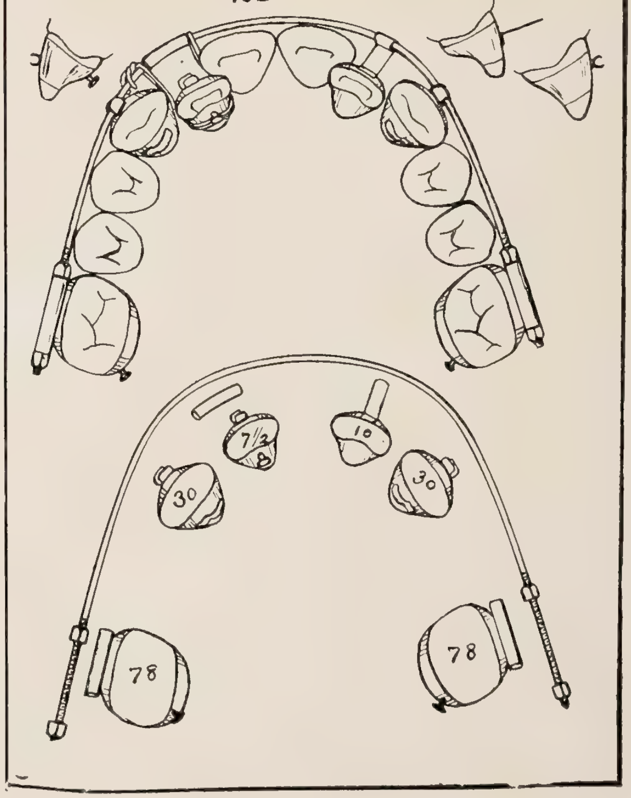
19.


83
83
30
30
23
23

20.


Lat.
Cusp
Bi.
Mol.
18
18
30
42
60
81
81

21


7½
10
30
30
78
78

of reaction, in the distal and lateral movement of buccal teeth for the proper enlargement of the arch. What has been said in regard to the importance of preserving or ultimately producing a condition of normal occlusion should always be remembered in every operation which contemplates the movement of buccal teeth.

The employment of the **positive force of a screw** for the correction of extensive lingual malalignments is far less painful and more effective than the wire ligatures suggested by Dr. Angle; while the adjustment treatments of the positive force, which require the simple turning of a nut, is greatly in its favor. If the line of force crosses the arch where a straight jack would interfere with the action of the tongue, either the resultant force of two jacks, placed without the boundaries of interference, can be projected upon the point, or the **drop** or **arc jacks** may be employed. In **Ap. 18,** the laterals are moved by the resultant of positive forces. The reaction of the protruding force tends to retrude the molars and allow for the distal movement of cuspids and bicuspids. The alignment bow prevents the teeth from being forced out of the arch. The pin attachment on the lateral bands (**B. 20**), in combination with the pin-rest jack bars in **Ap. 18,** permits opportunities of rotation if needed.

Apparatus 19

A variation of the foregoing apparatus for a similar irregularity on the lower will be found useful. In **Ap. 19,** provision is made for an extra nut upon the bars for locating the transverse jack well forward of the tongue. If it is desired to prevent the rotation of the laterals, the elliptical attachment (**B. 23**) for the spade-end jack bar is preferable. The lingual molar jack tubes are here soldered to the disto-lingual angle of the molars, (**B. 83**) — a form of attachment that is calculated to prevent rotation and permit free inclination movement.

It is understood that nearly all the appliances shown are applicable to both the upper and lower arches.

Apparatus 20

The lingual **curved push-bar** appliance on the contruded laterals in this case is supplemented with elliptical attachments (**B. 18**) for jacks which engage with the lingual bars. The lingual tube attachments on the cuspid and bicuspid bands are threaded for the attachment of the screw ends of the lingual bars. On the left side the combination of jack and bar expresses the principles of a reciprocating jack force, retruding the cuspid with the reaction of the protruding force on the incisor. On the right side, desiring to retrude the buccal teeth as much as possible, the bar is attached to the bicuspid with the distal end threaded and resting in a molar tube. In commencing the operation, the nut is screwed back against the molar tube and then the jack nut tightened, which obliges the molar to take all the reaction force at first. When a perceptible movement of the molar

has taken place, the bar nut is screwed forward against the distal end of the jack, transferring the force to the bicuspid; finally the bar may be removed and attached to the cuspid the same as on the left side.

In assembling this apparatus, the two incisor bands with the curved bar in place should be cemented first, then the cuspid and bicuspid bands, and finally the molar bands. The latter is described on p. 97. The jacks may be placed and force applied at the subsequent sitting. The alignment bow, No. 22, should be attached at the beginning of the operation, as in nearly all of these cases it will be found useful to not only keep the teeth in alignment, but to assist in minor complications that will arise or which already exist. In the later stages the lingual appliances may be removed and the final "truing up" of the position of the teeth may then be accomplished with the alignment bow, assisted with such bands and attachments as will be suggested.

As previously explained, it is rare to find a case that is not complicated more or less with some one or more of the other groups of simple and complex malpositions; and while the main portion of the operation may be carried forward to its full completion with the apparatus as shown, it will more often require — especially in the later stages — the assistance of other forces.

Apparatus 21

The drawing illustrates the **expansion arch bow** No. 18. It also shows a **variation** of Dr. Angle's method of aligning an inlocked right lateral with the small brass wire ligatures. The wire is passed round the tooth in the form of a double loop and fastened to the bow at the ends of a thin curved tube which is slipped on the bow before placing. The length of the tube can be gauged so that the wire will exert an expanding force upon the adjoining teeth to make room for the lateral.

On the left lateral is seen the Matteson attachment, which consists of a strip of Nos. 28 or 30 plate, cut as shown, and soldered to the labial face of the band. The end is lapped over the bow and rolled in under with the pliers. The force is increased from time to time by rolling it up on the bow. For aligning contruded teeth where there are sufficient spaces or where employed in connection with other appliances for opening space, the author prefers it to the wire ligatures.

Both of these methods, however, give far more pain in their treatment adjustments than the positive force of a screw which is always sure, comparatively painless, and therefore to be preferred in the alignment of all *extensive* contrusions, and especially for inlocked upper incisors.

The mesial and distal nuts at the molars are frequently of advantage for expansion bows. They lock the bow firmly in position and permit a movement of it in either direction by unscrewing one nut and screwing up the other. It should be remembered, however, that this locking of a tooth to a heavy arch bow increases its immovability and establishes to that extent a stationary anchorage quality.

Therefore in all instances which have been previously cited, when a distal movement of the buccal teeth is desired for the correction of the occlusion and which is possible from the reaction of other forces contained within the apparatus, a small sized wire is chosen for the bow to hold the teeth in alignment, because it answers every purpose and yields readily to an inclination movement of the molars. This principle should always be taken advantage of in the application of the disto-mesial action of the intermaxillary force. Moreover this is one of the principal reasons why it is more scientific and effective to apply this force distally to the molars through the medium of sliding tubes and intermaxillary hooks, which glide upon a small resilient arch bow, than through the medium of a heavy arch bow to which the intermaxillary hooks are immovably attached.

Apparatus 22

One of the most common irregularities is that of an **upper inlocked lateral incisor,** with its space in the arch more or less closed. **Apparatus 22** is designed to open the space with the curved push bar; its action being controlled with the alignment bow. The lateral is forced to its position with the **resultant** of two positive forces as shown. The reaction of these forces may often be utilized in the accomplishment of other very important movements.

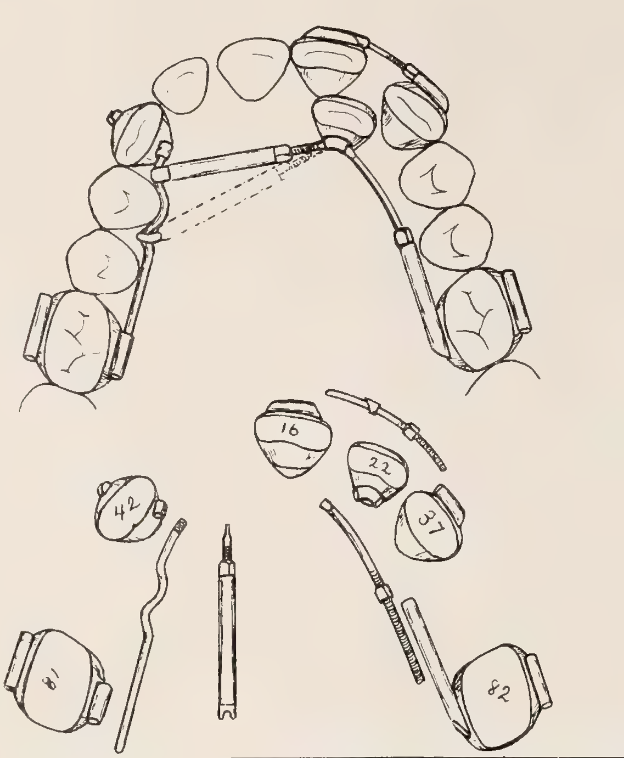
It should be understood that **space** for the lateral is of **first** importance, after which, in all minor malalignments, the malposed tooth or teeth may be easily forced to place with elastic or wire ligatures through the medium of the arch bow.

Lingual jacks should not be employed except in cases which demand considerable force, and where the positive action of a screw will eliminate a deal of trouble to the operator and pain to the patient. In cases where the incisors are deeply inlocked back of the lower teeth, screw force, from a stable anchorage, is eminently demanded, because it insures a steady outward movement though forcibly opposed at first by the overlapping occluding teeth. Moreover, the certain though gradual movement enabled by the firm grasp of the appliance, which at no time releases its hold, makes this one of the safest as well as the least painful of methods.

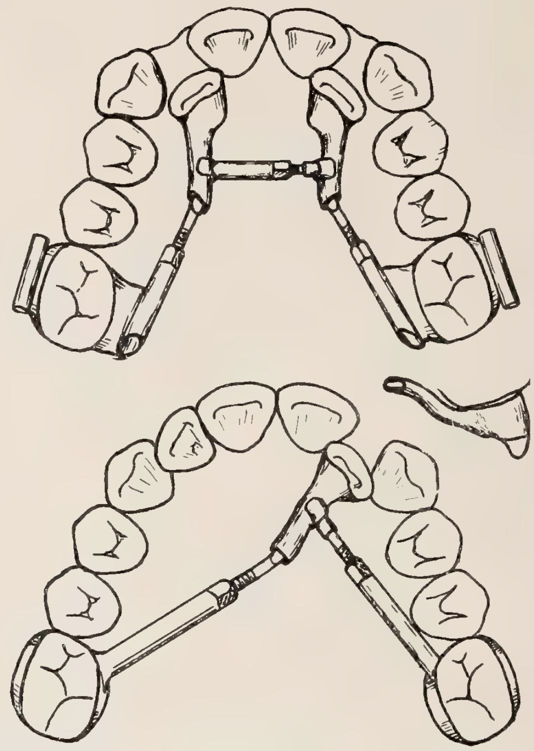
In the irregularity shown it will usually be more advisable to employ a curved distributing bar on the right, attached to the left central with **band 14** as in **Ap. 17.** This will cause the reacting force of the jack to aid in opening the space for the inlocked lateral while the distributing quality of the bar will be increased. The force of the jack can also be directed distally upon the molar by using the **fork end jack** as shown in **Ap. 16**; the bar of the jack being made sufficiently long and curved to conform to the arch.

Lingual motive appliances, such as jacks, bars, etc., should always be chosen and fitted in such a position as to give no irritation or interference with the tongue. It is for this reason that two jacks, with their resultant force, are so frequently employed where one jack could otherwise do the work. For this reason also the Drop and Arc jacks are frequently useful.

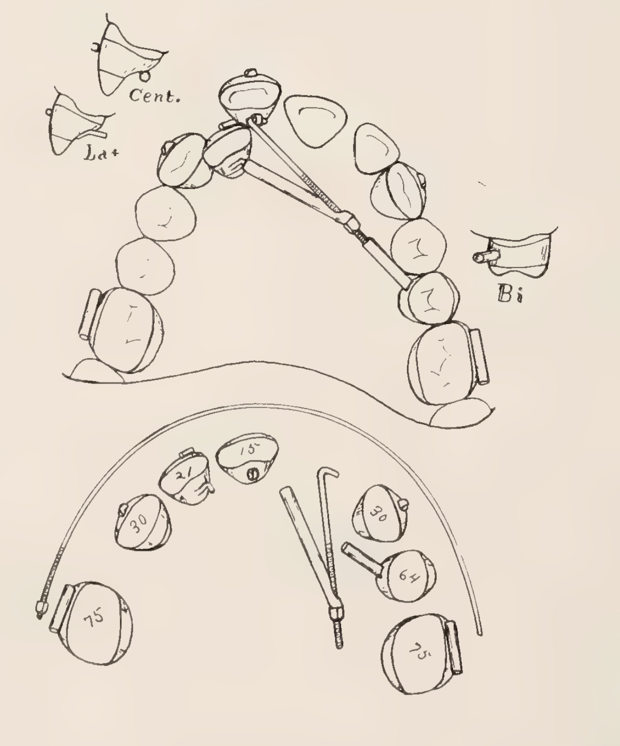
22.



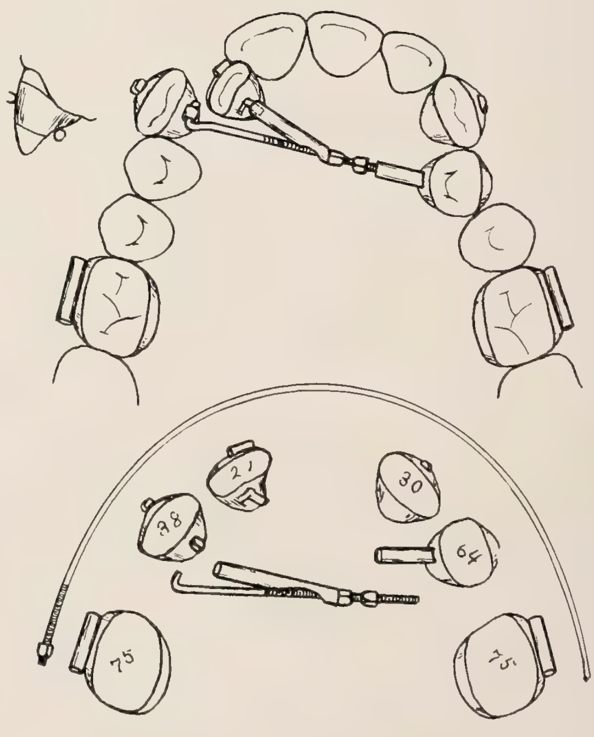
23



24.



25.



Apparatus 23

Bodily Movement of Laterals.—Occasionally the posture of **inlocked lateral incisors** will show that the apical ends of the roots are retruded quite as much as the crowns. If force is applied for the correction of these teeth in the usual way upon the crowns, it will be found in marked cases, when carried to alignment, that the labial inclination of the crowns quite perceptibly mars the perfection of the arch. This may be obviated by constructing the appliance as shown in **Ap. 23**, so that the line of force is directed well upon the roots of the teeth.

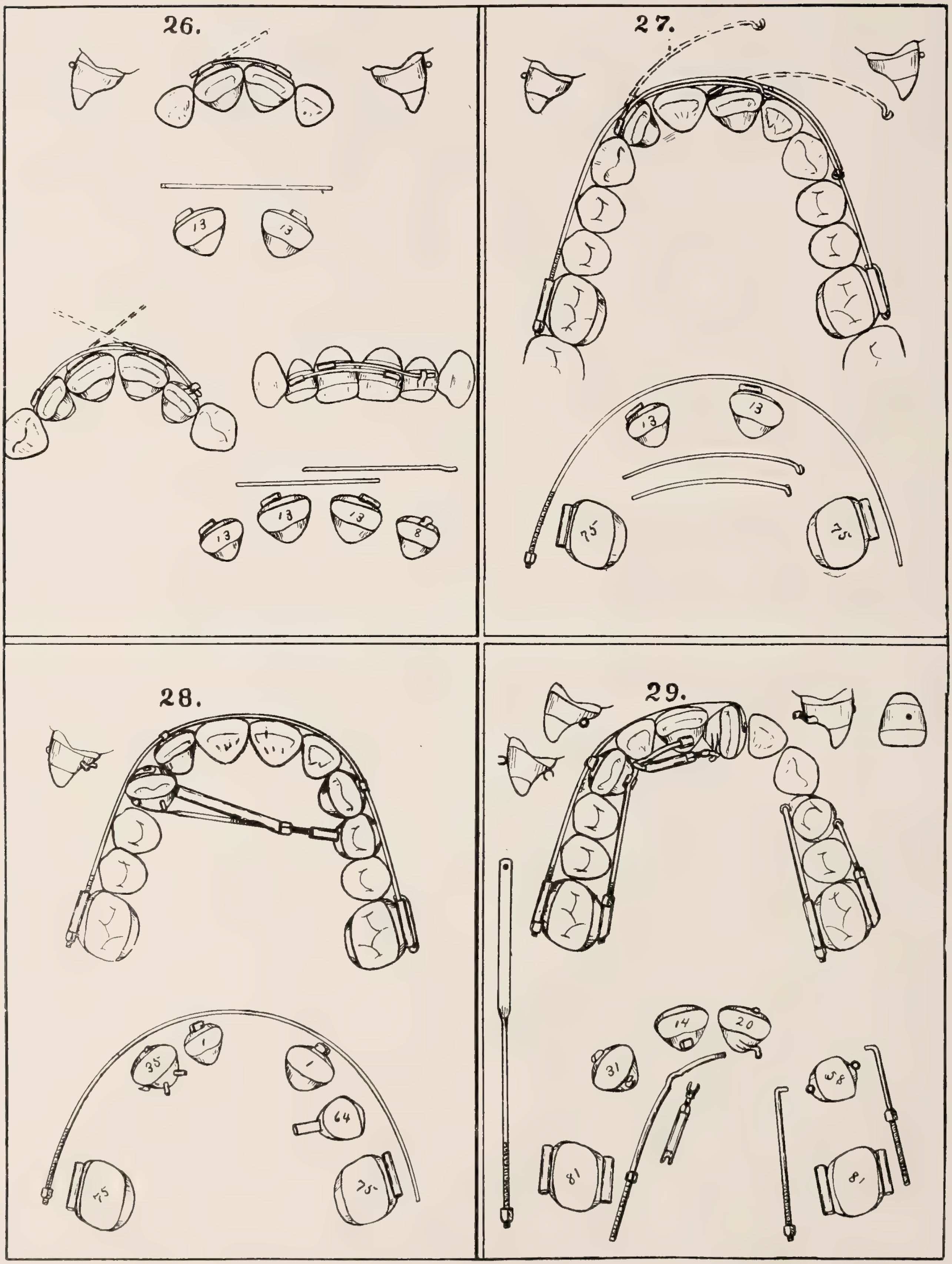
To wide lateral bands are soldered flattened tubes into which has been inserted flattened wire to stiffen them, leaving the ends open for the spade-end of the jacks. The bands are then tried on the teeth and the extension tubes are bent to conform to the shape of the palatal surface. The anchorages as shown are made by soldering the lingual tubes to extension plates attached to the molar bands. The small intervening jack will control and direct the resultant of the two forces. In the lower part of the drawing is shown a variation of the conditions and appliances which will be found effective where only one lateral is involved.

The drawing does not fully show the perfection of this apparatus, which in all its essential parts is fitted to lie close to the gum tissues with little or no interference with the tongue. The enlargement of the arch is accomplished with an arch bow, Nos. 19 or 18, attached to bands not shown in the drawing.

When the incisal ends of the laterals are forced to alignment, if it is then found that the crowns are labially inclined, an alignment bow should be attached to arrest the forward movement at the occlusal zone which will thus act as a static fulcrum for the further bodily movement of the roots.

Apparatus 24 and 25

Reciprocating Jack.—When adjoining teeth are malposed, the one within and the other without the line of the arch, the reciprocal action of the two forces required to correct them may be admirably accomplished with the **reciprocating jack**. This simple appliance, introduced a number of years ago, has never received the full appreciation it deserves, probably because its application and power were not understood. It will be seen that by simply turning a nut the appliance pulls upon one tooth and pushes with an equal force upon the other. The left bicuspid attachment is a tube, merely to support the end of the bar and keep it from swinging around. When the appliance is placed the extreme end of the bar only should rest in the tube, leaving space for it to glide into the tube as the tooth to which it is attached moves to position. A variation is shown in **Ap. 25**, by which this movement may be stopped with an extra nut, and the force transferred to the bicuspid. In the employment of these jacks the arch bow is usually indispensable for enlarging the arch and opening the required space for the malaligned teeth.


26.
27.
28.
29.

CHAPTER XIX

GROUP III. MALTURNED TEETH

One of the most common malpositions of front teeth is that of being abnormally turned in their sockets. During the processes of eruption, the front teeth are commonly obliged to crowd their way into the arch between deciduous or permanent teeth, unless deflected completely out of alignment. In so doing they are naturally malturned by the deflecting influence of their broad and somewhat thin incisal borders coming in contact with adjoining teeth. Later, through the influence of natural growth of the jaws, and muscular action, favored by the anatomical shapes of the more rootwise forms of the crowns, they commonly assume a normal pose. Where the alveolar arches do not sufficiently enlarge by growth, and where teeth are otherwise prevented from assuming their natural pose by muscular action or the forces of malocclusion, they become permanently fixed and so remain malturned and often overlapping until corrected by artificial means. This, however, is but one of the many causes of malturned teeth.

In the **correction** of malturned teeth by mechanical rotation, the principle to be remembered is, that **mechanical advantage** is increased in proportion to the distance from the central axis of the tooth at which the force is applied. Therefore for the rotation of the labial teeth, the force should be applied at or near the gingival border. See Rotating Movement in Principles of Force, p. 77.

As stated in other parts of this work, the author does not attempt to give every variety of irregularity and complication that may arise in practice, but only some of the common forms of malpositions, for the purpose alone of showing practical methods of correction and principally the application of implements and appliances which any ingenious mind will be able to vary to suit the case in hand. The special force exerted by different methods will be briefly described with the appliance.

Apparatus 26

Spring Lever Rotators.— The rotation of teeth with a resilient piano-wire bar, was first definitely introduced by Dr. E. H. Angle of St. Louis. In a paper presented at the Illinois State Dental Society in 1894, the author introduced the present variation in the method of its application, which he is pleased to say has rendered this principle of rotating teeth one of the most valuable in his practice.

For incisor teeth that are moderately turned, and for cuspids that are slightly turned, the method is quite effective if the principles of the force are understood, mechanically applied, and properly contrnlled.

Where the incisors are malturned and in slight lingual malalignment resilient bars or levers may be effectively attached in the manner shown in **Ap. 26.** But it should be remembered that no combination of this character should ever be placed upon the teeth without the controlling force of an alignment bow. As explained in Chapter VI, the force exerted by the elasticity of the wire in its efforts to straighten itself, with its ends unable to slide in its attachments, will tend to carry the teeth into labial malalignment, which would render it a dangerous expedient, with the possibility of not seeing the patient for several days.

Apparatus 27

The **rotating lever** which the author has found most effective is Nos. 20 or 22, drawn without annealing from No. 9, extra hard 18% German silver wire. This gives to the wire a resiliency nearly equal to the piano wire, and quite as effective for all practical purposes without the oxidizing tendency possessed by steel. Cut the wire into 1½ inch lengths; anneal one end and bend it to a hook having the double curve shown in **Ap. 27.**

The rotating tube attachments — preferably seamless — should have very thin walls, Nos. 32 or 34, drawn to fit exactly the bars, so as to hug the band and present no prominent or irritating edges; and to take such position on the tooth when placed as will be most effective for its rotation. **(See B. 13.)** In placing the lever, see that its length is such as to allow it to hook to the bow at an interproximate position, and bend the hook so that the lever when placed will lie smoothly along the bow.

Apparatus 28

Positive Reciprocating Force.— For the rotation of teeth which are extensively turned, especially the cuspids and bicuspids, the application of positive reciprocating forces, (a principle which the author introduced in the early '90's) is certainly the ideal method for rotating a tooth upon its long axis, which requires considerable force and movement.

There are various ways in which reciprocating forces may be applied. That shown in **Ap. 28** is by a **reciprocating jack,** one end of the bar being rolled to a ribbon No. 35 thickness, and buttoned to the labial face of the cuspid. (See **B.'s 35 and 19.**) Means are provided — as will be seen in the construction — for preventing the ribbon from sliding toward the gum, also, for changing the location of the tube to the second pin when the first has passed out of its line of grasp.

The tube attachment on the bicuspid to support the free end of the bar should be longer, if possible, than that shown in the drawing, as considerable movement of the bar will occur in the rotation of the tooth.

In assembling the appliance, see that only the extreme end of the bar enters the tube rest, so as to give it all the opportunity of movement which the tube

will permit; and even then it may be found necessary before the tooth is fully rotated, to loosen the jack, snip off a portion of the ribbon-end, and punch a new button-hole; or if preferred, remove the bicuspid band so as to cut off a portion of the bar. The removal of a band with proper pliers for the purpose of recementing it is a comparatively easy operation. See Fig. 59, Chapter IV. In all cases where opportunity is given, both ends of the tube-rest attachment should be open to allow free movement of the reciprocating jack bar.

If the cuspid is **lingually malaligned,** a second nut at the bicuspid tube will force it to place while it is being rotated. See **Ap. 25.** With this combination, the bicuspid position should be reinforced, as shown by **band 63.**

If the case presents no other complication than that shown by the drawing, the alignment bow and its provisions may be dispensed with.

Apparatus 29

In nearly all cases of considerable rotation which do not also require inclination movement, it will be found by a little study that reciprocating forces can in some form be applied. A not uncommon malposition is that of a central incisor turned one-quarter round and locked in that position by adjoining teeth. In **Ap. 29,** a No. 19 **fork-end jack,** resting on a lingual spur hook on the malturned incisor exerts a rotating force, the reaction of which being received upon the lingual bar attached to the right central, exerts an expanding force to open the space; while the **ribbon-end traction bar** buttoned to the labial face of the malturned incisor, from a molar anchorage, completes the reciprocating rotating combination. In the drawing will be seen a malturned upper first bicuspid which frequently offers great resistance to rotation, on account of its bifurcated roots. A simple and very effective method is here shown for the application of the reciprocating forces of pull and push bars attached to **band 58,** from a molar anchorage.

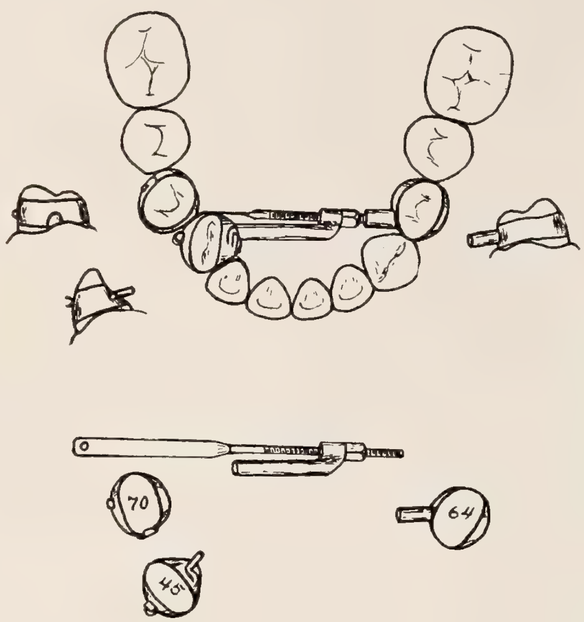
Apparatus 30

A variation in the construction of the **reciprocating jack** as illustrated in the present drawing, is indicated where the lines of the two forces are nearly parallel. The appliance is especially applicable for the rotation of an adjoining cuspid and bicuspid as shown, which require also inclination movements in the direction of the two forces. It will be seen that the pull ribbon end of the jack is buttoned to the buccal face of the bicuspid and the push-tube rests at the linguo-distal aspect of the cuspid.

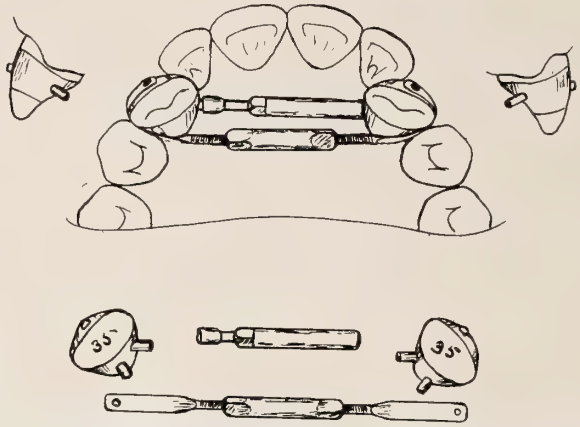
Apparatus 31

Turn-buckle and **Swivel Traction Jacks** (See Figs. 46 and 47, p. 30, Chap. II) are among the most useful and effective of regulating appliances. With many conditions where they are especially indicated no other appliances seem capable of taking their place.

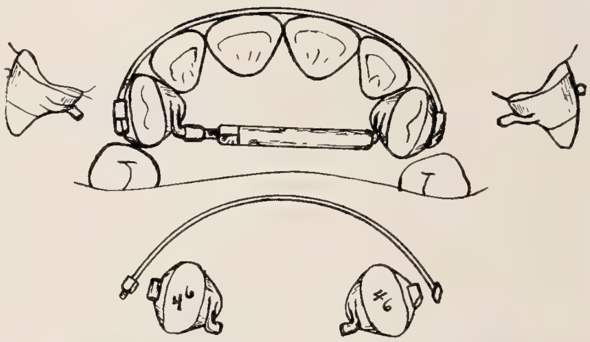
30.



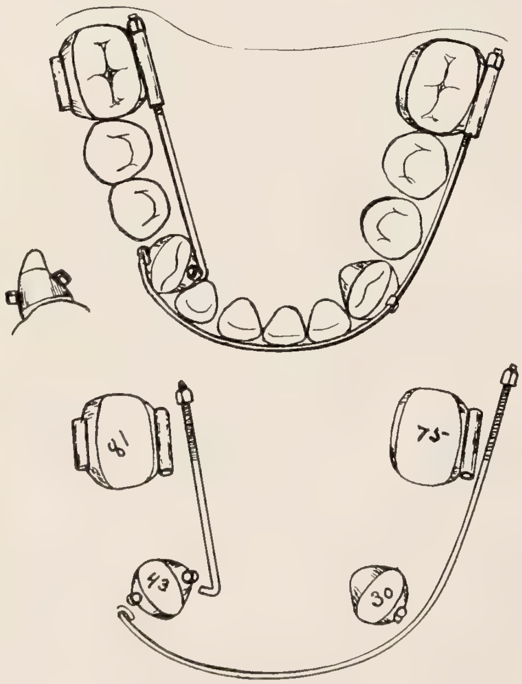
31.



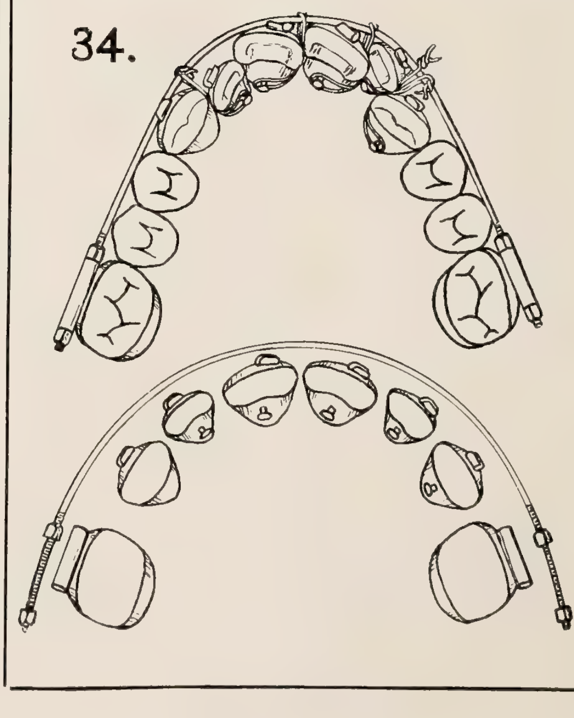
32.



33.



34.



The frequent occurrence of **malturned cuspids** and the difficulties commonly experienced in rotating them, has led the author to present a variety of methods for applying positive rotating forces. This does not apply to those conditions that require slight rotating forces and which may be easily corrected with the Angle wire ligatures, resilient rotating bars, etc. In **Ap. 31** both cuspids are malturned labio-mesially and in lingual malalignment. With the application and reciprocal action of a **push-jack** and a **turn-buckle jack** both teeth to which they are attached can be turned, and at the same time moved toward or from each other. The ends of both bars of the turn-buckle jack are rolled to a ribbon attachment and buttoned to **band 35,** a device that is especially effective for the rotation movement. In combination with the push jack as shown, reciprocal inclination movement can be produced or prevented. For instance, if the cuspids are in lingual malalignment, the greater force should be exerted by the push jack and vice versa; or they can be rotated without inclination movement by an equal application of force to both jacks.

Apparatus 32

When both cuspids are malturned labio-distally the position of the above jacks may be transposed, or a traction bow may be used in place of the ribbon traction jack, as shown. This combination is especially indicated in those cases where the incisal arch is protruded, and the labial arch narrow or V-shaped, or where interproximate spaces require closing. If the straight jack is found to interfere with the tongue the **Arc Jack** with the curve of the tube placed to conform to the arch will obviate this difficulty.

Apparatus 33

When one cuspid is labio-distally malturned, reciprocating labial and lingual traction forces may be applied, as in **Ap. 33.** A No. 23 arch alignment wire is sufficiently large for the labial force and a No. 19 traction bar for the lingual. These are attached to the cuspid **band 43** by means of short tube attachments. The cuspid end of the labial wire is annealed and when in place is bent sharply back on the attachment. The wire should be supported at the opposite cuspid by an open-tube attachment. This combination will be particularly indicated where retrusion of the labial teeth is required. It should be remembered also that much force exerted by the small labial traction wire will tend to contrude or flatten the arch along the central portion of its bearing — in this case at the left cuspid area. This may be prevented with a jack from the left cuspid to the lingual traction bar. Where the contruding force of the labial traction wire is not required however, a buccal push bar from the right molar anchorage engaging with a spur upon the cuspid will be found equally effective. This combination which is well shown in **Ap. 29,** with the forces reversed, is one of the most practical methods of rotating the cuspids and bicuspids in the author's practice.

Apparatus 34

Wire Ligatures for Rotating — As before mentioned, the employment of Dr. Angle's **wire ligatures** is an effective method of rotating and aligning teeth, especially when there is sufficient interproximate space for the play of the wire. But it happens that malturned teeth are usually *crowded* teeth, which are turned in that position so as to occupy less space. This means that their contact surfaces are at or near the gingival or cervical margins. In order to pass a wire that is sufficiently large to exert the required force through this crowded interproximate space to its attachment upon the teeth, its passage will frequently need to be far beneath the gingivæ with possible injury to the pericemental membrane, if allowed to remain in that position long. The too frequent employment of these wires in the hands of many who do not appreciate this danger, and especially upon unbanded teeth with no attachments to prevent the wires, not otherwise controlled with the arch bow, from slipping to the crevices will doubtless prove in time the reaping of a whirlwind of pyorrhea cases, if no greater disaster ensues. There are many instances, however, where this method of moving teeth is applicable and effective, and where a judicious employment of a **doubled strand** of the smallest size of the wires will prove a valuable adjunct in Orthodontia.

In the author's hands its most effective application for the rotation of teeth is in conjunction with a resilient alignment bow, Nos. 20 or 22, so that the elasticity of the bow may be utilized to add a potential quality to the force for its greater continued action.

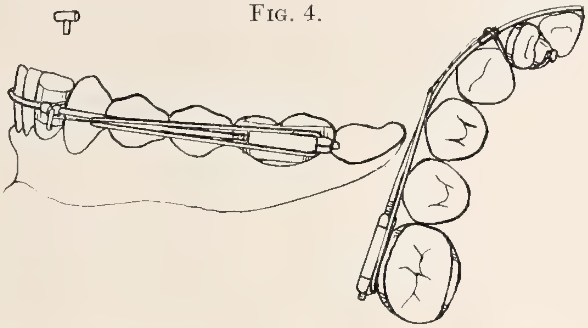
In **Ap. 34** the ends of the wires are shown more twisted than they would be at first, especially upon a heavier bow; the purpose being to show how they may be twisted upon the lighter spring bows whose potential resiliency would exert a more gradual force and not require the repeated painful renewals of the ligatures which commonly break with a subsequent twist. The projecting ends of the wires are intended to be tucked back out of irritating prominence.

The most perfect method of applying the wire ligatures is described by Dr. Angle as follows: "When applying a wire ligature a piece long enough to be firmly grasped by both hands should be used, so that strong tension may be exerted when making the twist. This should never be more than three-fourths of a turn at first. The surplus ends are then clipped off, leaving projections one-eighth of an inch long. These ends are then curled under the arch, thus providing a smooth surface to the lips."

Rubber Ligatures for Rotating. — One of the most convenient, effective, and easily adjusted methods of rotating contruded lower incisors and other teeth which are not extensively malturned is with the employment of **rubber ligatures.** Those who have witnessed the wonderful results accomplished by the small rubber ligatures, in their intermaxillary application, will not question the adequacy of the continuous force when properly applied for the rotation of teeth.

There are many ways in which the elastic rings may be applied that will suggest themselves to ingenious minds according to the conditions and requirements. In Fig. 1, under **Ap. 8,** is shown how they may be applied for the correction of lingually malaligned lower incisors. If one or more of the incisors, shown in the figure are malturned, as nearly always obtains with this irregularity, the loop instead of passing completely around the tooth may pass only around a lingual pin-head attachment or hook, and back through the same interproximate space that it entered.

Fig. 4.

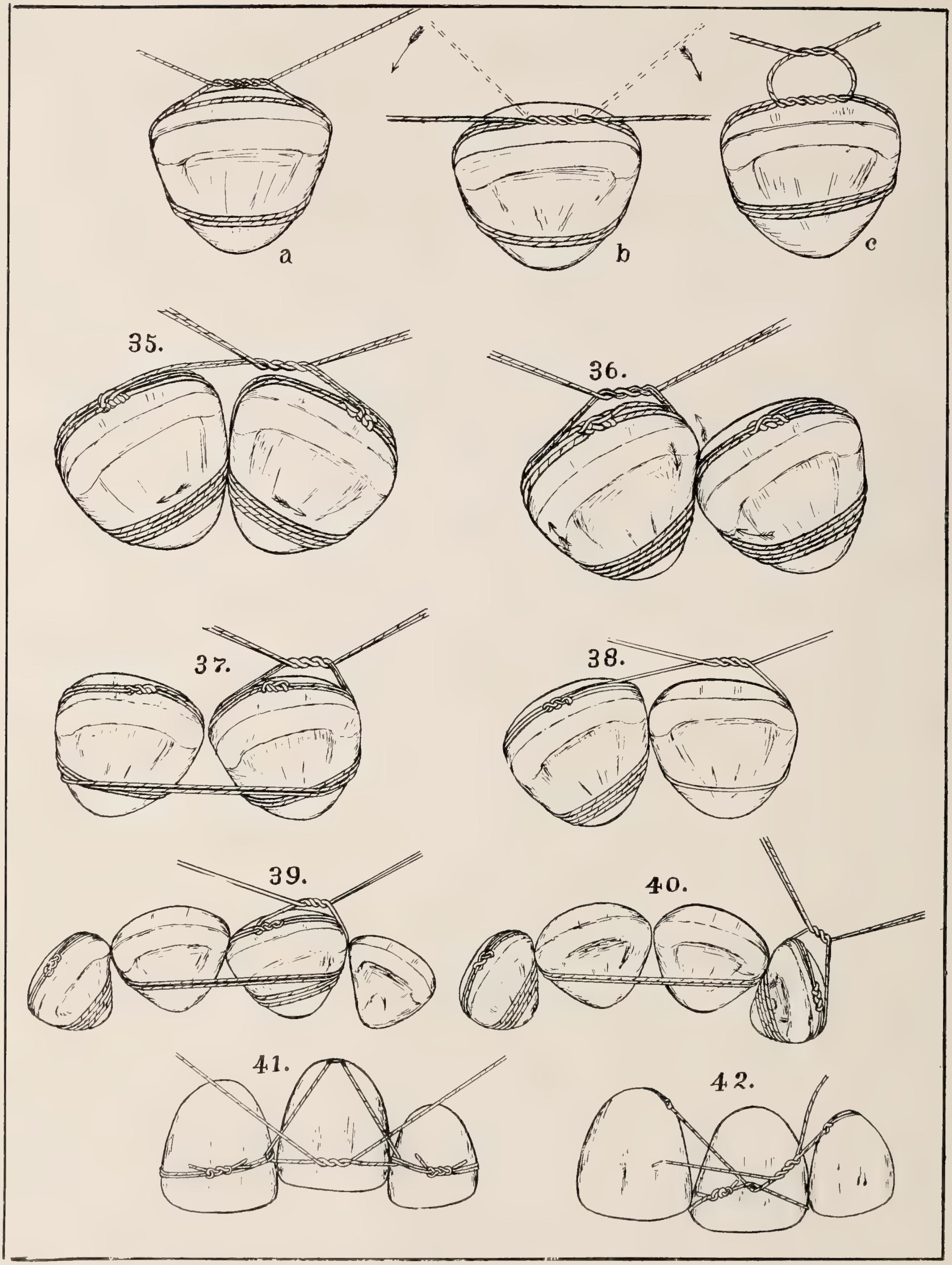


When only one tooth requires rotating, a loop of Corticelli A silk ligature may be passed over the pin-head attachment and the ends carried under a T, attached to the bow and tied to an election ring, which is looped over the anchorage attachment, as shown in Fig. 4. In this way you can increase the elastic force to any desired degree by doubling the ring back on itself. The T attachment is made by soldering a spur to a short thin-walled tube of a size to exactly fit the bow, to which it is soft soldered at the required position. Were it not for the attachment upon the bow the elastic force of the rubber upon the cuspid, over which it would pass, would tend to contrude it, unless it was secured to the bow with a band attachment.

Silk Ligatures for Rotating, etc.

Silk and linen thread have been used for all time in the regulation of teeth, but the honor is due to Dr. W. J. Younger, now of Paris, for first practically demonstrating the remarkable effectiveness of very small silk ligatures, and for special methods of securing them to teeth to obtain the greatest possible advantage of their qualities.[1]

For malturned teeth that require a slight rotating force for their correction and for the prevention of rotation movement from the action or misapplication of other forces, Corticelli A silk ligatures, if properly applied, will be found invaluable. The retention of a rotating ligature when tied to a tooth, and its subsequent potential action, is due quite as much to the resilient quality—found only in the smallest of silk threads,—as to the method of its application. An important advantage of the smaller sizes is also their greater freedom from becoming foul, so common with the larger ligatures.


a
b
c
35.
36.
37.
38.
39.
40.
41.
42.

To tie a silk ligature to a tooth, that will not slip while exerting a rotating force, requires special methods of procedure. First: the ligature should be thoroughly waxed except at that portion of the middle which is sufficient to pass *twice* around the tooth to be rotated. Second: pass the unwaxed portion *twice* around the tooth and form the first half of the knot by passing one end through the loop *twice* and even *three* times, to prevent it from slipping after drawing it tightly to place. Third: while grasping the ends of the ligature firmly, lift the tie from the tooth with all the force which the ligature will bear (See "a"), then suddenly drop the hands while keeping up the tension, to take up all the slack (See "b"). By repeating this movement once or twice it insures drawing the double loop round the tooth to its fullest tension. Fourth: the balance of the knot is finished by passing the end through the loop *once*, either way, and drawing it firmly to place with a slight right and left movement (See "c"). Fifth: the double strand is grasped and carried in the direction of the desired force.

Fig. 35 shows methods of rotating the central incisors labio-mesially. After tying the ligatures to both teeth as described, the double strands are again passed around the teeth in the direction of the desired force and tied with a sailor knot at the most prominent point on the face of one of the teeth. The same movements in tying the first half of this knot should be made as in the first knot, "a" and "b," as much of the effectiveness of the method lies in storing up all the potential force which the resiliency of the silk fibres will permit without breaking. To prevent the first half of this tie from slipping back while the balance of the knot is made, it is usually necessary for the assistant to hold it with a piece of orangewood. The ends are then cut off close to the knot.

Fig. 36 shows method of rotating adjoining incisors that are malturned in the same direction.

Fig. 37 shows method of rotating central incisors labio-distally.

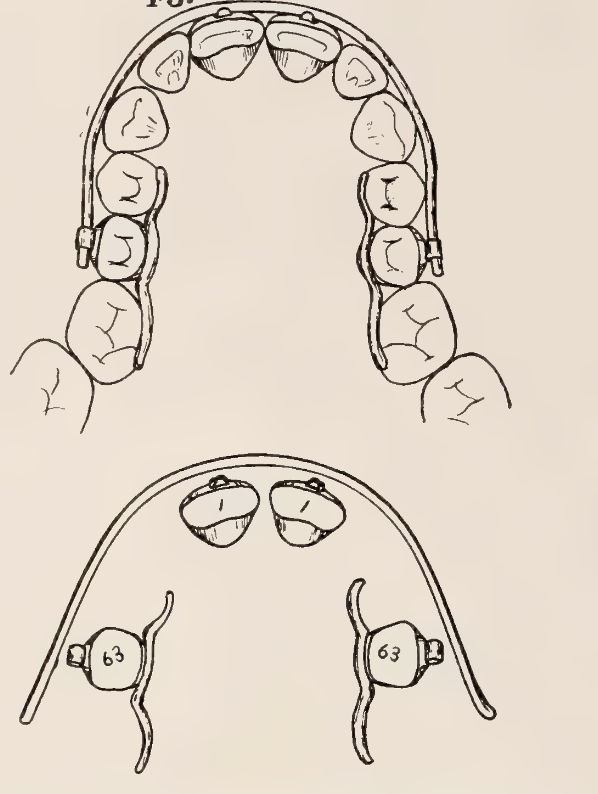
Fig. 38 shows method of rotating a single incisor. After carrying the double strand around the tooth, it is separated and tied to an adjoining tooth so as to produce no rotating force upon the latter. Whenever possible the double strand should be tied to a double strand from another tooth which requires rotating, though it may be quite distantly located. The potential resiliency of the ligature is increased in proportion to its length. With this in view, the author frequently ties the double strand from a single malturned incisor to that of another double strand from a molar anchorage.

Fig. 39 shows method of rotating a central and lateral in the same direction.

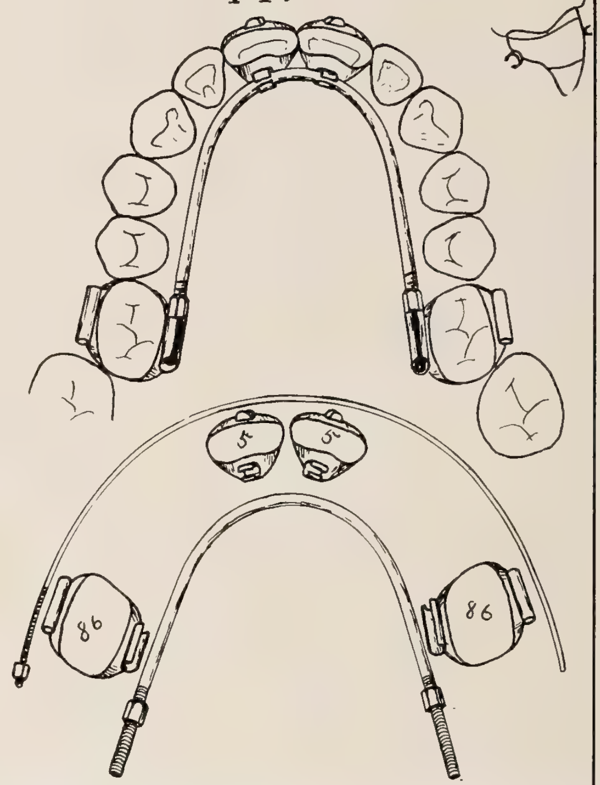
Fig. 40 shows method of rotating the laterals in opposite directions, or labio-mesially.

Figs. 41 and 42 show methods of extruding and intruding a single incisor with silk ligatures.

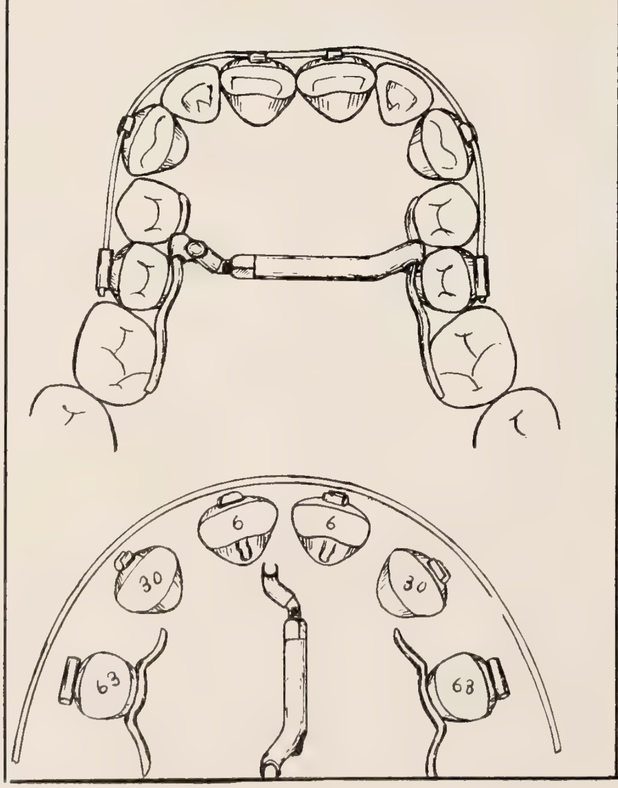
43.



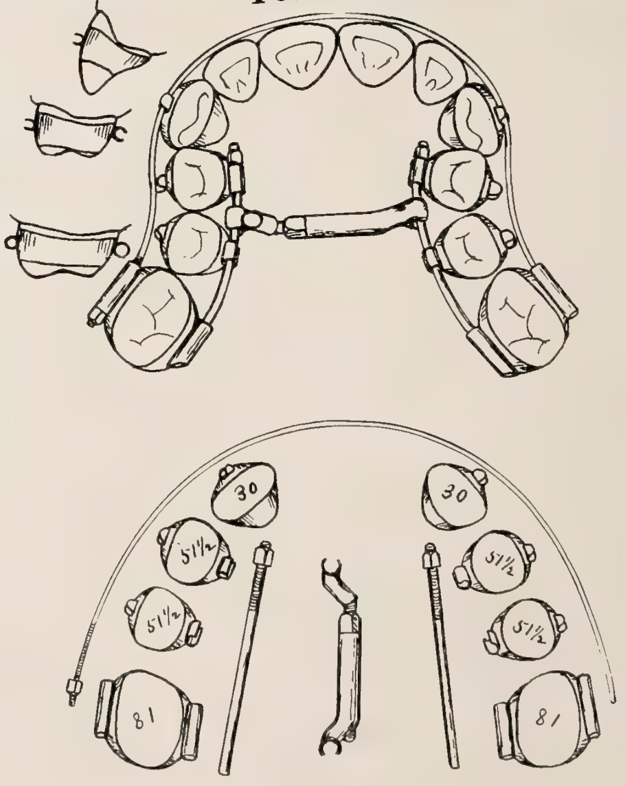
44.



45.



46.



CHAPTER XX

GROUP IV. CONTRACTED AND EXPANDED ARCHES

Laterally contracted arches of various forms and from various causes is one of the common characteristics of irregularities of the teeth.

In the early history of the correction of irregularities by means of dental plates the lateral expansion of the arch was considered the all-important and necessary preliminary step in nearly all cases that required room for placing the teeth in alignment. Indeed so prevalent did this idea become with the frequent expansion of arches to unnatural and disfiguring widths by the use of the Coffin and other expanding plates, that even to-day it is difficult to eradicate the impression and substitute in its place the far more important **distal movement** of the bicuspids and molars, when demanded to restore them to proper positions of occlusion, from whence they may have drifted through the premature loss of deciduous teeth. The lateral expansion of the arch, however, will always remain one of the important movements in correction.

The two principal means employed by the author for the lateral expansion or contraction of the dental arch is that which is afforded (1) by the elastic force of a **spring bow**, and (2) by the positive force of a **screw**. The former is especially applicable for expanding or contracting the buccal area, especially in the molar region, because its greatest action is at the ends, with a diminishing movement as it approaches the center of the bow: while the latter, through the aid of several forms of jacks, can be made to locate the force at any lateral area upon either arch, or distribute it evenly to the two sides for a general expansion. The methods which are here presented for applying the positive force for the lateral expansion of arches have been brought to such a high degree of perfection through the medium of the **Drop, Arc,** and **Turn-buckle Jacks,** it would seem that no other force for this purpose would ever be required. And yet there are times when a **spring bow,** if properly employed and adjusted — especially as an auxiliary in the apparatus for applying other forces — will be found very effective and with no special annoyance to patient or operator.

The methods shown by the apparatus in this Group apply particularly to marked cases of **laterally contracted** and **expanded arches.** It is therefore hoped that the author will not be understood as discrediting the usefulness of the arch bow, or what Dr. Angle has named the "expansion arch" for a less but more general expansion and alignment of the entire arch, and which is fully explained and shown in apparatus of Group II. The author does not approve, however, of the method now often employed in expanding dental arches by forcing the teeth

out with wires to large rigid arch bows that stand far away from the teeth, because there are other ways that are quite as effective and far more preferable for many reasons.

The **labio-buccal** and **lingual bows** shown in this Group for expanding and contracting the buccal area of the dental arch, are made of fairly large spring German silver wire, Nos. 13 or 14, drawn without annealing from "extra hard" Nos. 8 or 9. They are then bent to lie closely against the surfaces of the arch when sprung into position, where they are held by neatly constructed attachments; the force being exerted purely through the resiliency of the bows. The object of a heavy bow is, that it will exert the desired force approaching the positive quality when sprung *slightly* out of equilibrium, so that its action may be *limited* to the desired amount of movement, and thus avoid the danger of moving the teeth too far, which might otherwise arise between long intervals of treatment. One of the principal objects in limiting the scope of its action also is the need of leaving it on the teeth for some time after the desired movement is accomplished to aid in the establishment of permanent retention, an event that would not be possible with a bow that continued to expand after its object had been accomplished.

Apparatus 43

When the **buccal area** of the arch is **contracted** as shown with **Ap. 43,** the bow is first bent to lie evenly along the outer surfaces of the teeth. After cutting it the proper length and polishing the ends to avoid irritation, the bow is sprung outward to a point of equilibrium that is slightly beyond the desired movement, as a portion of its full resiliency will be lost in the process of adjustment. Lingual D wire extensions, soldered to the bicuspid **bands 63,** are bent to conform to the surfaces of the teeth to which they are to distribute the force. The buccal attachments consist of a short closed tube on one side and an open tube on the other, the latter being placed to open either gingivally or occlusally. The bow is supported in front with thin open-tube attachments on the incisors. In assembling, place one end in the closed tube and spring it into place, then close the open tubes and smoothly finish projecting edges. The bow can be easily removed from the clasps at any time for the purpose of increasing its tension.

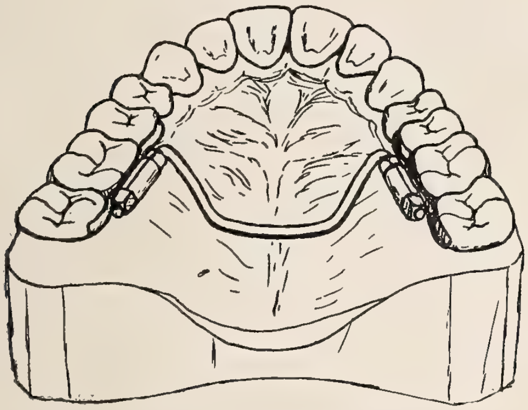
This appliance as shown will also exert a slight contruding force upon the labial teeth with a tendency to close interproximate spaces. Its scope of usefulness in this particular may be increased, if needed, by reinforcing the stability of the anchorages and threading the ends of the bow for distal nuts.

Apparatus 44

Lingual spring expanders with the ends of bows resting in molar or bicuspid tubes, are usually to be preferred to the labio-buccal spring expanders, unless it is desired to use the latter also as a medium for applying other forces. In **Ap. 44,** the force is directed upon the first molars, though any or all of the back

teeth could be made to receive it. The ends of the bow are threaded and rest in open lingual tubes with mesial nuts, which prevent the bow from sliding back in the tubes as it otherwise would do, if not attached to the incisors, which is not always convenient. This bow can also be used as a medium for other forces aside from that of expanding the distal area of the arch. In many cases requiring a lateral expansion the labial teeth are protruded. By attaching all the incisors to the bow their position may be corrected with distal nuts at the anchorages. In all protruding cases where the occlusion will permit, with contracted arches of Type A, Class II, and also those which have demanded the extraction of bicuspids, the lingual expanding spring bow can be attached with equal effectiveness to the stationary molar anchorages that are employed for the retruding movement. In many instances besides those in which the occlusion will not permit the lingual bow to extend to the labial teeth, it will be found quite as effective and far more pleasant to the patient to bend it in conformity to the dome of the arch which it may cross at various positions. In **Ap. 56** the bow is employed for contracting, but the same form of bow may be used for expanding. The bow may also be made to take a more posterior position across the dome as shown in Fig. 5.

Fig. 5.

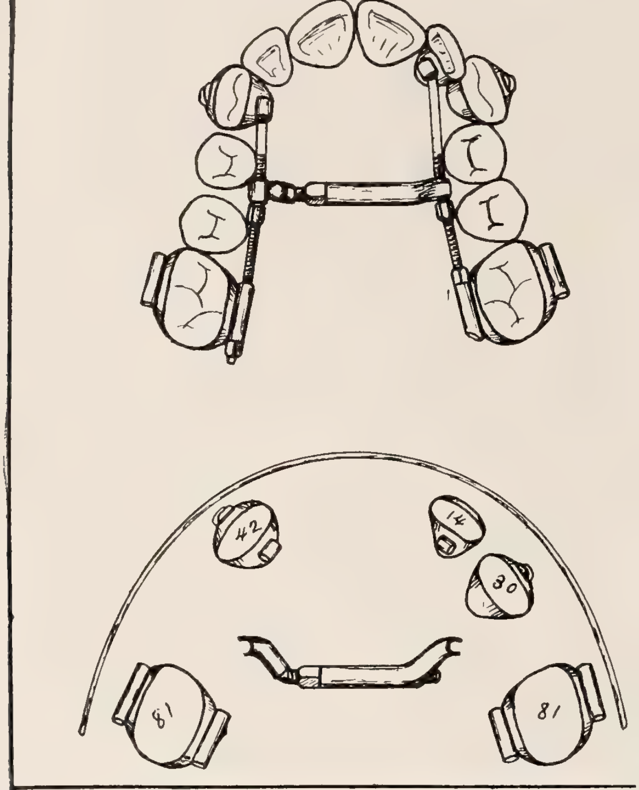


Apparatus 45

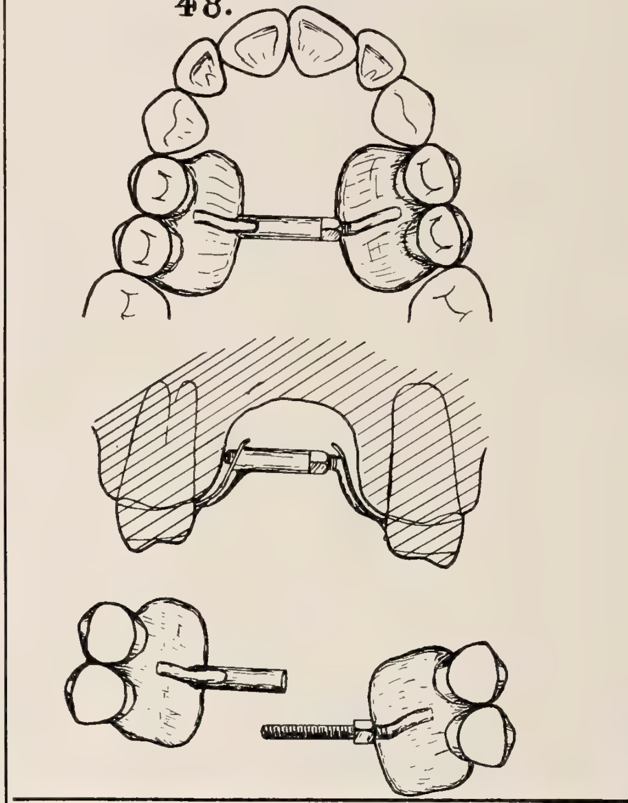
Drop Jack.— While spring bow expanders are applicable for the lateral expansion of distal areas, the ideal power for the enlargement of either the upper or the lower arch in every direction will always be the motive force of a screw. In **Ap. 45** is shown the application of the **Drop Jack** used here for the lateral expansion of the arch. The **Drop** and **Arc Jacks** are far superior to the straight jacks for crossing the upper arch, as they do not present the same unpleasant obstruction to the action of the tongue. Patients who are greatly annoyed and irritated with the one will wear the other without complaint.

In the irregularity shown the arch is flattened across the front with an expansion of the inter-cuspid area. In addition to the action of the expanding jack, a resilient wire, No. 19 or 20, shaped the same as that shown in the disassembled appliance, is sprung into the attachment as illustrated. The force of this will gradually protrude the incisal area, and contrude the cuspids.

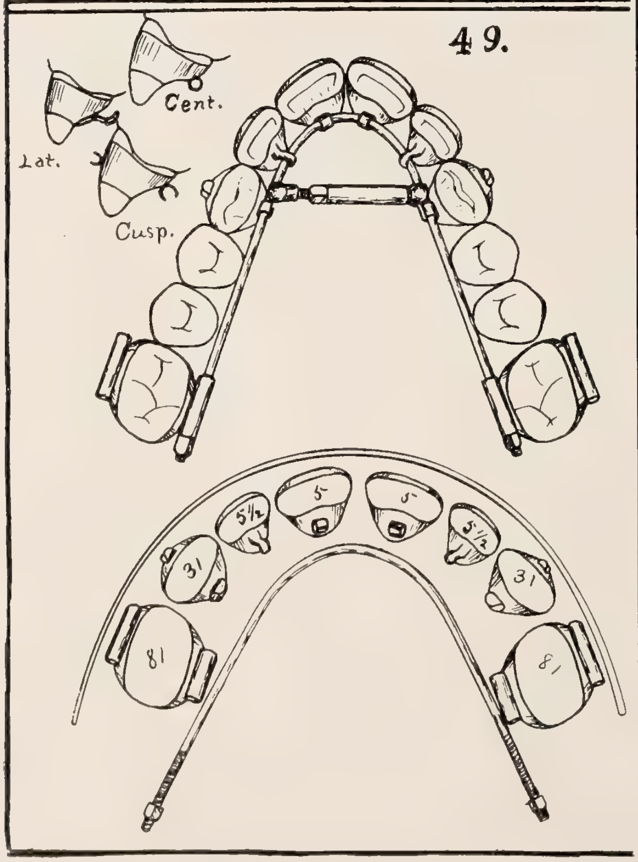
47.


42
14
30
81
81

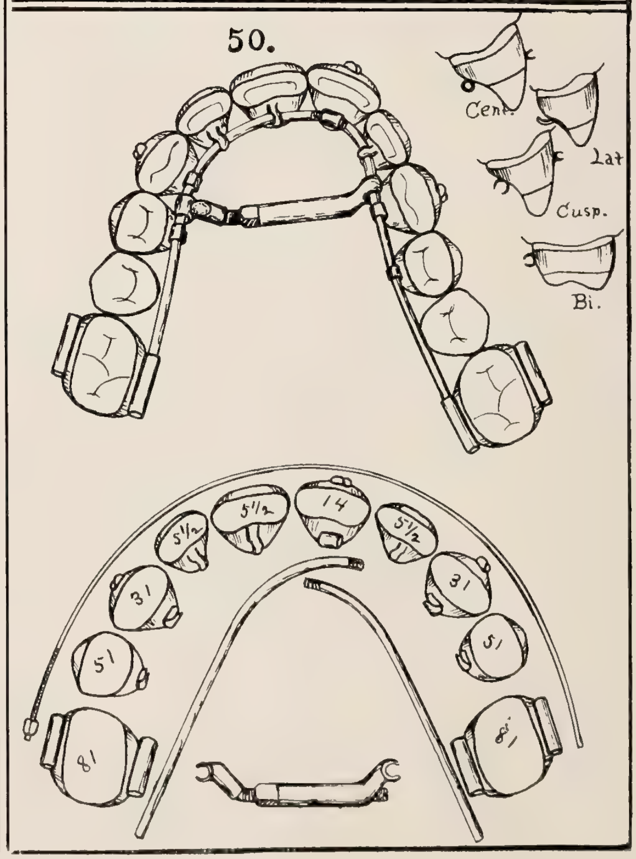
48.



49.


Cent.
Lat.
Cusp.
5½
5
5
5½
31
31
81
81

50.


Cent.
Lat
Cusp.
Bi.
5½
5½
14
5½
31
31
51
51
81
81

Apparatus 46

This drawing shows a typical **saddle-shaped arch,** contracted at the bicuspid area, more or less expanded at the molar area, and with labial arch fairly correct. The principal force of the apparatus is that of the expanding jack, but it will be seen also that the spring force of straight lingual bars which are placed in the molar tubes and then forced into their attachments on the bicuspids are important factors in swinging the molars back to alignment, the whole movement being aided by the resilient force of the arch alignment bow, Nos. 19 or 20.

Apparatus 47

Lingual bars for distributing the force of the **drop or arc expanding jack** may be threaded, as shown in **Ap. 47,** to exert a pull or push force from the molar anchorages, and also to carry nuts for the location of the jack. Provision should always be made as shown with apparatus of this character for the attachment of an alignment bow for other desired movements.

Apparatus 48

Apparatus 48 shows an effective method for bodily expanding the upper arch. The bands should be wide, No. 34, perfectly fitted and contoured, with lingual borders extending beneath the gum, to possess long and rigid grasps of the crowns. When the bands are fitted to the teeth take plaster impression and fill with investing compound with bands in place. The lingual plate extensions — clasp metal No. 27 — are swaged, fitted, and raised to stand free from the gum and soldered to the bands on the model as shown. The jack No. 14, reinforced with rib extensions, is then fitted and soldered. It is needless to say that the whole is assembled and cemented together. This apparatus should be watched in its action to avoid undue irritation of the underlying gum tissues.

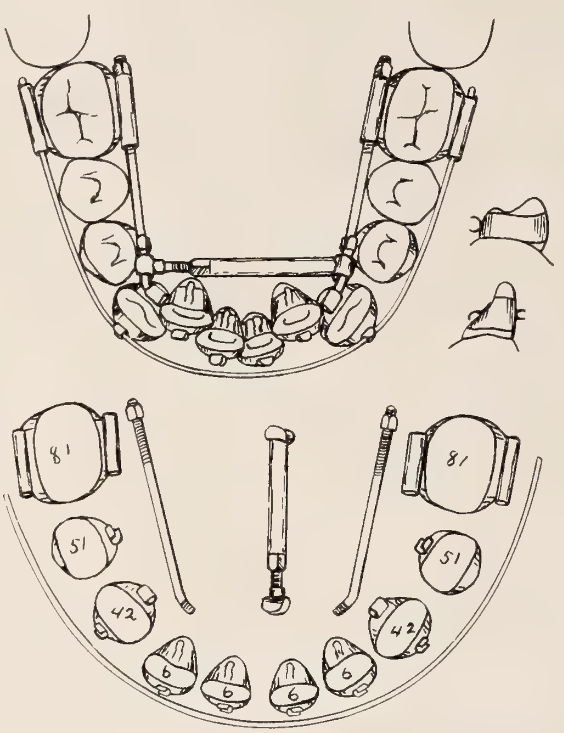
Apparatus 49

V-shaped arches may be expanded and the incisors brought to normal arch alignment with an expanding jack No. 14, resting upon an **annealed,** or **semi-hard lingual bow,** No. 18, attached as shown by the drawing. It will be seen that the lateral expansion of the bow in a line with the cuspids, will retract and enlarge its anterior curve and — if the anchorages are stationary — will retrude the front teeth to the full extent of this movement. If the contraction of the arch is not symmetrical — one side being contruded slightly more than the other — the bow may be annealed at the point of greatest contrusion, which will enable it to more readily bend outward under the strain of the jack.

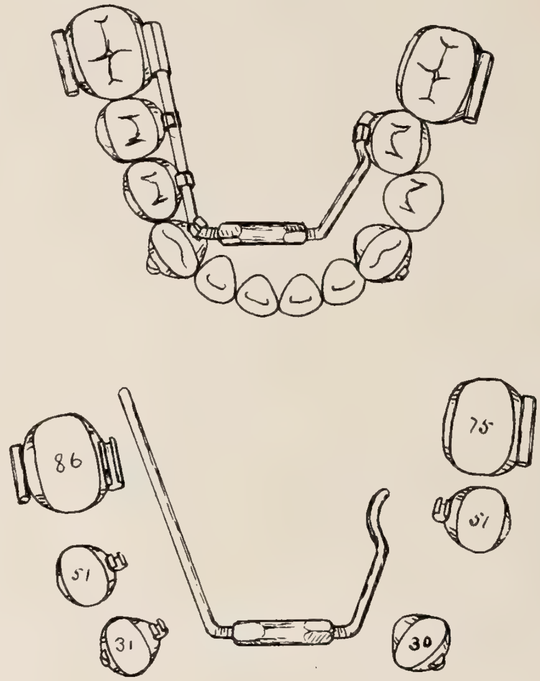
Apparatus 50

If **one side** of the dental arch alone is **contruded,** the normal side should be united to receive and distribute the force of reaction so as to permit no move-

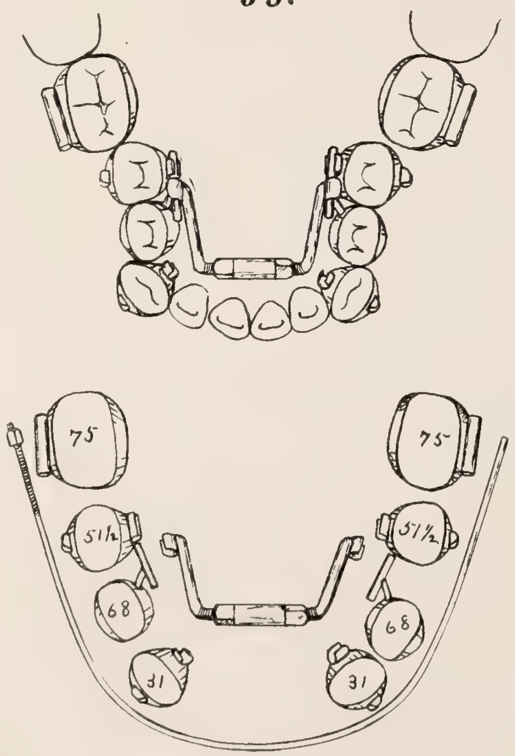
51.


81
81
51
51
42
42
6
6
6
6

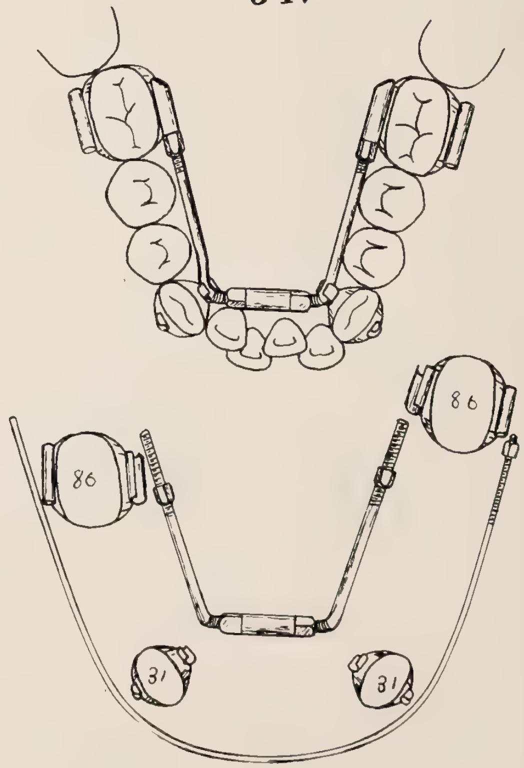
52.


86
75
51
51
31
30

53.


75
75
51½
51½
68
68
31
31

54.


86
86
31
31

ment of the united phalanx. In **Ap. 50** the right lingual distributing bow is extra-hard No. 16 wire, screw attached to the left central band, and bent so as to rest evenly upon the lingual surfaces, and grasped by the attachments of the other teeth as shown. The left lingual bow is **semi-hard** No. 18 wire, screw attached also to the left central and grasped by the other attachments as shown. The location of the jack will be governed by the desired movement, and its position changed, if indicated, in the progress of correction.

Apparatus 51

The **expansion** of the **lower arch** is somewhat more difficult than the upper because of the tongue, though patients will frequently bear without complaint or special irritation a straight jack crossing the lower arch as far back as the interproximate bicuspid spaces. But an extensive distal location is now made unnecessary by the use of **Arc** and **Turn-buckle Jacks.**

The drawing shows an apparatus particularly designed for expanding the labial arch upper or lower, to make room for the alignment of incisors. The lingual bars are screw-attached, though they may be soldered directly to the cuspid bands. They are also threaded for distal nuts on the molar anchorages as would be indicated for closing buccal inter-spaces.

The malposed incisors are usually brought to place and rotated if necessary with silk or rubber ligatures as soon as space for their movement permits. A single loop of Corticelli A silk, or a rubber ring — preferably the red kind manufactured by Ash & Sons — can be adjusted from the alignment bow, as shown in Fig. 1, **Ap. 8.** With an irregularity similar to that shown in **Ap. 51,** the alignment bow, No. 20 or 22, should be at once sprung into the grasp of the open-tube attachments on the centrals, and later into the attachments on the laterals, when sufficient space enables them to be brought nearly to place with the ligatures.

The lower incisor bands should be never thicker than No. 40 to avoid the useless occupancy of space; and commonly it is unnecessary to band the lower incisors, the alignment bow being sustained by the open-tube attachments on the cuspids nearly in a line with the gingival borders, which will prevent the ligatures from slipping off the teeth or passing under the gingivæ. Moreover the lower incisors without bands may be rotated with silk ligatures, tied as directed on p. 225, and the double strand brought out to the bow and back to the other teeth, etc. Or they may be brought forward and rotated with the wire ligatures as in **Ap. 34.** Where no very great force is required, as commonly obtains, elastic ligatures adjusted from the start, as in Fig. 1, **Ap. 8,** will usually bring the teeth to alignment as rapidly as the expanding of the arch will permit them to move. Where one or more of the teeth require rotating, instead of passing the rubber loop around the tooth it may be looped over a pin-head attachment and passed back through the interproximate space, etc.

Arc Jack.— One of the latest implements designed for expanding the dental arch, and for other purposes is the **Arc Jack.** It has come in response to the same need which created the Drop and Turn-buckle jacks, and for many conditions it is far superior. It is made in several forms: one to be sustained with the arc towards the dome of the upper arch, and others with the arc towards the labial arch. The latter is especially useful in expanding the lower labial arch, and for the correction of many malpositions where a straight jack would interfere with the tongue.

Fig. 6.

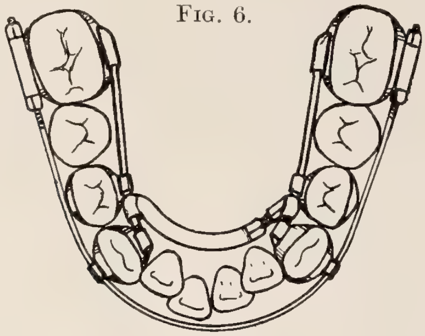


Fig. 7.

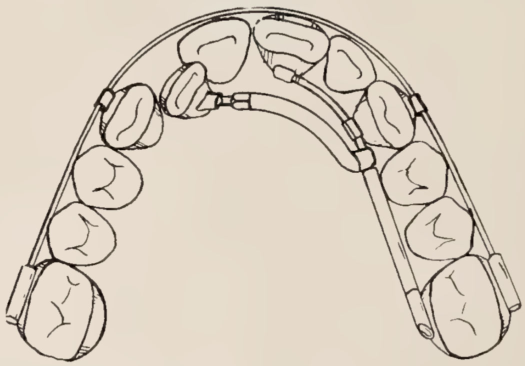


Fig. 6 shows the application of the **Arc Jack** for expanding the anterior area of the dental arch. Fig. 7 exhibits one of its advantages in place of the straight jack. Fig. 8 shows its relation to the dome in expanding the arch at the bicuspid area.

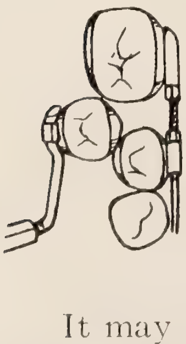
Fig. 8.

The action of this jack differs from the drop jack in that the height of its curve increases, taking it further out of the way of the tongue as the arch expands.

Apparatus 52

Turn-buckle Jack.—Occasionally a lower first molar or second bicuspid—and sometimes both—are in decided lingual malalignment and inclination, requiring considerable force for correction. **Ap. 52** shows a simple and effective means of correction with the **Turn-buckle Jack,**— an appliance that was first introduced by the author in 1894, and one that is especially applicable for all expanding purposes on the lower jaw, as the body of the jack can be placed in a position that will give little interference with the tongue.

Fig. 9.



In the combination shown, the force of reaction is sustained by four teeth on the right side; and even this is not always sufficient unless the space for the bicuspid is but slightly closed. The anchorage may be greatly reinforced by soldering a straight lingual bar, No. 18, from one cuspid band to the other.

It may also be found advisable to open the space for the malposed tooth or teeth, before attempting to force them into alignment. For this purpose a

straight push bar, resting in buccal tubes upon adjoining teeth with attachments similar to the **curved push bar** in **Ap. 15,** will be found effective. But if the case demands an arch bow for the alignment of other teeth the end may be threaded for the distal and mesial nut to act at this point the same as the push bar. See Fig. 9.

Apparatus 53

This drawing shows a favorable and very effective method of **expanding** the **lower bicuspid area.** Various means may be employed to sustain the jack other than that illustrated. In nearly all cases of this character, the molars will have drifted forward to a partial closure of the bicuspid spaces. The mesio-distal relation of the molars in occlusion as regards the normal will at once indicate whether or not they should be moved distally with the intermaxillary force to insure perfect occlusion of the teeth when finished.

Apparatus 54

The **lateral expansion** of the **lower buccal teeth** including the cuspids is most successfully accomplished with the **Turn-buckle Expanding Jack,** shown in the drawing. The distal ends of the arms are threaded for hexagonal nuts to be placed mesially to the open-tube rests on the molars.

In assembling the Turn-buckle Expanding Jacks the arms should first be bent and shaped to lie evenly in the buccal attachments, and then finally sprung outward so as to exert a more forcible pressure upon the posterior teeth, as in placing the spring bows. The advantage of the turn-buckle over the spring bow expanders and contractors is that the screw movement permits locating the force at the anterior portion of the arch.

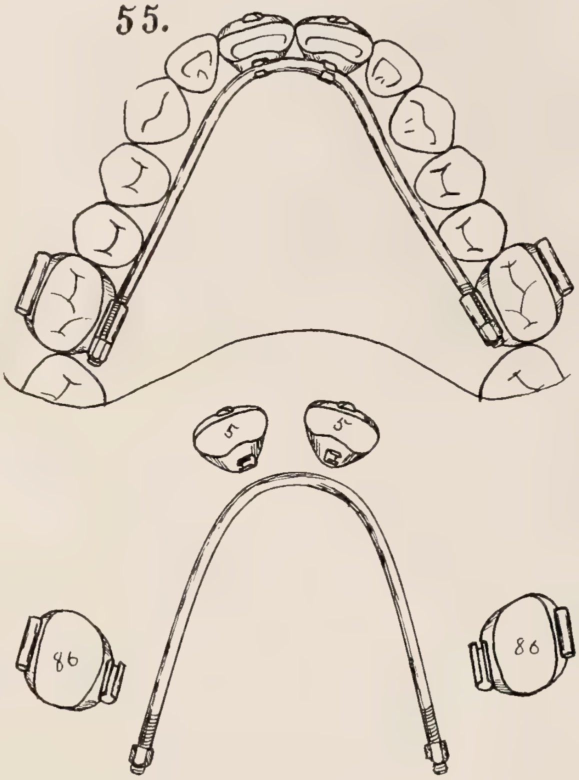
Care should be observed in springing the arms in either direction with the hands, with the view of causing the appliance to exert a greater force at the distal area, as it will be seen in such a movement that its greatest strain is brought upon the points where the arms enter the turn-buckle, and consequently upon the weakest parts of the arms, where they are deeply threaded, which may break them, or bend them, so as to obstruct a free action of the screw. Furthermore as the bends should usually be made at the angles near the threaded and weakest parts, the **heavy wire benders** (See Fig. 31, p. 329) are indispensable for this purpose unless the arms are unscrewed and otherwise grasepd.

Fig. 10.

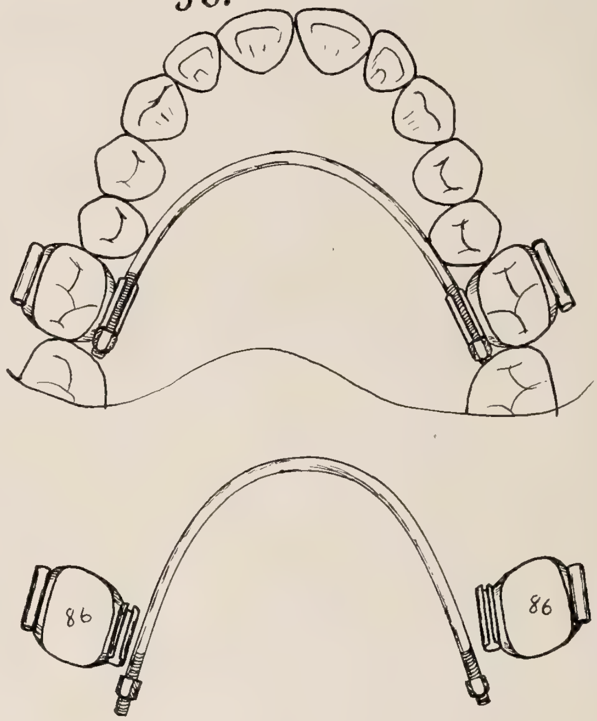
These bending pliers will also be found convenient for shaping the arms to the teeth, and for all purposes within and without the mouth where heavy bars require to be given short bends.

The cuspid band attachment (**B. 32½**), shown in Fig. 10, is usually more applicable than **band 31,** as it permits locating the turn-buckle at a more distal position.

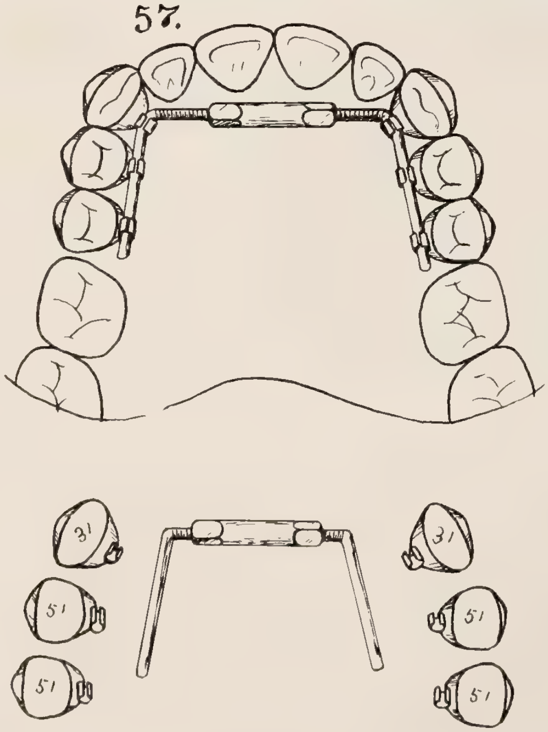
55.



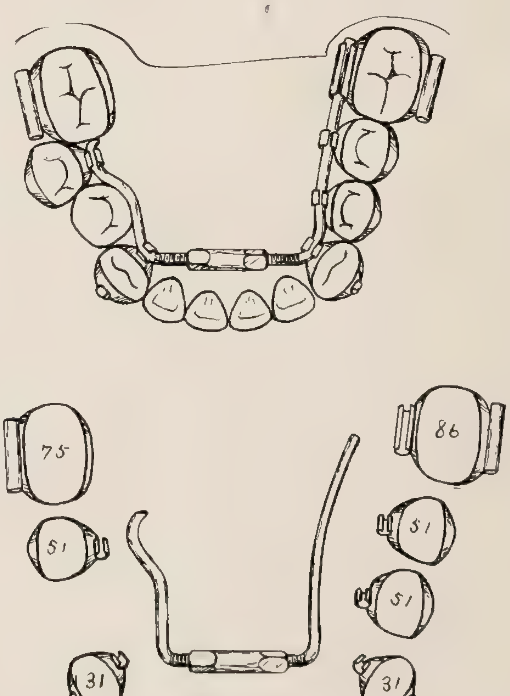
56.



57.



58.



Lateral Contraction of Arches

Apparatus 55 and 56

Spring Contractors. — Practical methods are here shown for **contracting** the **molar area** with a No. 14 or 16 lingual spring bow. The bows are drawn from extra-hard No. 9 German silver wire and given the proper curve and length to be grasped by the open tubes upon the malposed molars. If the adjoining teeth require this force, arms for distributing the force, as in **Ap. 43,** should be soldered to the buccal surfaces of the molar bands. As the force of a contracting bow will always tend to carry it forward, the ends are therefore threaded for distal nuts to prevent this contingency and also to draw the bow back to take up the anterior extension caused by its contracting movement.

In **Ap. 56** the bow is made to lie close to the roof of the mouth just back of the alveolar ridge. The distal nuts are quite as useful with this bow as with the other. The bow may also be bent to take a position directly across the arch following the curve of the dome as shown in Fig. 5, under **Ap. 44**. This is a favorable form, as it can be placed so as to give no annoyance to the tongue.

The molar tubes should be soldered to open towards the occlusal surfaces. In the trial fitting of the bow, bend it so that it will properly lie in the open tubes and along the gingival margins of the teeth or dome of the arch without exerting any force. Then remove it and bend it by springing the ends together to a curve that is a trifle more than the desired movement. Place one end in position and spring the bow into the opposite tube. The tubes should then be closed and all irritating edges removed.

Apparatus 57

Occasionally the upper labial arch (and sometimes both the upper and the lower) will be flattened or foreshortened with an abnormal width at the cuspid and bicuspid area, producing an unhappy flattened effect of the lips. **Ap. 57** shows an effective method of contracting the anterior portion of the arch with the **Turn-buckle Jack,** which requires no explanation further than to say it would probably be found necessary to finally attach an alignment bow to "true up" the arch, etc., and give to it the proper symmetrical curve.

Apparatus 58

A malposition which has been quite difficult to correct is where a lower second bicuspid or a molar upon one side of the mouth is in decided buccal malalignment. This now is made easy by the traction force of a **Turn-buckle Jack,** as shown by the drawing, one arm of which is anchored to all the teeth on the opposite side. The right cuspid attachment should be employed only as a rest.

CHAPTER XXI

GROUP V. ABNORMAL INTERPROXIMATE SPACES

The irregularity which is characterized by an **abnormally wide space** between the central incisors and occasionally between a central and lateral, and of which the patients, older than 25 or 30 years of age, will tell you that, in the main, it is of somewhat recent origin and "is gradually growing worse," is not difficult to temporarily correct, but it is frequently impossible to retain in position without a permanently attached fixture; especially if it happens to be an inherited type or one of long standing. This irregularity is at times an exceedingly unhappy one in appearance, besides being very liable to seriously interfere with perfect vocal enunciation. In one case the space was so wide that the patient was wearing an artificial extra incisor of nearly full width between the centrals.

Causes

The causes are: Inheritance; Abnormal frenum labium; Malocclusion; The loss of one or more back teeth; and, indirectly, Pyorrhea. In many instances in the author's experience where the space occurred between the centrals alone — which is the type of this irregularity — there seemed to be no cause for the condition other than that of inheritance. This original space, which the action of the lips does not close, predisposes to a wider opening should a local cause arise.

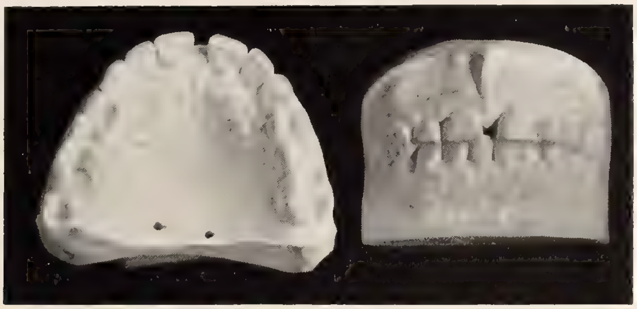
If caused from the low attachment of the frenum, whose muscular fibres frequently extend through between the centrals to the palatal gingiva, cocaine should be injected and its abnormal attachment to the bone completely freed, and the excess of tissue removed to avoid reuniting. If this is discovered early and operated upon before the eruption of the cuspids, no other treatment will usually be found necessary.

Of the local causes, malocclusion is the most frequent. The gradual wearing away of masticating surfaces will occasionally cause the lower front teeth to act as inclined planes to the upper teeth, resulting in a general expansion of the upper labial arch, and the opening of this single wide space between the centrals. This will especially occur if the lower cuspids and incisors are allowed to forcibly occlude along the inclined lingual planes of the uppers. See Fig. 11.

The tendency of the teeth to close buccal spaces produced by the extraction of masticating teeth, especially if permitted or aided by the occlusal facets, is doubtless a frequent cause of this opening. In these as in other cases, it will be found that the lower front teeth occlude against the lingual surfaces of the upper,

forcing the latter to drift distally and open the incisal space. Otherwise, as is repeatedly seen, especially on the lower arch, from the extraction of a molar, the entire front portion of the arch on the affected side moves back and the front teeth maintain their proximal contact.

Fig. 11.



A case recently presented at the author's clinic with a wide space between the left upper central and lateral was caused by the extraction, about two years before, of the left first permanent molar. The remarkable feature of this case was that the four teeth moved distally half the width of a lateral incisor, though distinctly opposed by the well-worn bicuspid occlusal facets, causing the teeth to ride upon opposing cusps and necessarily become more or less intruded. This is a fair sample of the force of Nature to close spaces caused by the extraction of masticating teeth, of which there are many instances, resulting in decided irregularities and in some cases causing facial deformities. The force exerted by the action of the muscles of the lips and cheeks is one of the principal causes of this movement.

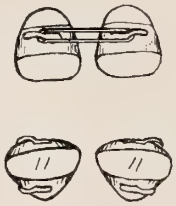
All dentists of experience have witnessed the tendency of pyorrhea to open abnormal spaces between the crowns of affected teeth, crowding them at times forward or against the adjoining teeth with a degree of force that can hardly be accounted for.

In the correction of the characteristic irregularity to which we particularly refer, shown in Fig. 11, it is not difficult to bring the teeth together by very simple means, but the principal treatment should be directed to the removal of the cause or causes and to final retention. It is imperative that the local cause be removed. If all of the labial teeth have drifted distally to close the space of an extracted tooth they should be forced back over the path of their movement and an artificial crown inserted to restore the integrity of the arch. If the occluding facets of the bicuspids have been one of the factors of movement, these should be properly ground.

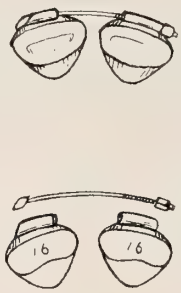
If the wearing away of masticating surfaces has permitted the jaws to come closer together and the lower front teeth to act as spreaders to the uppers, it may be found imperative to extract a lower incisor and contrude all the lower front teeth to fill the space, thus making the lower arch conform to the demands

59.

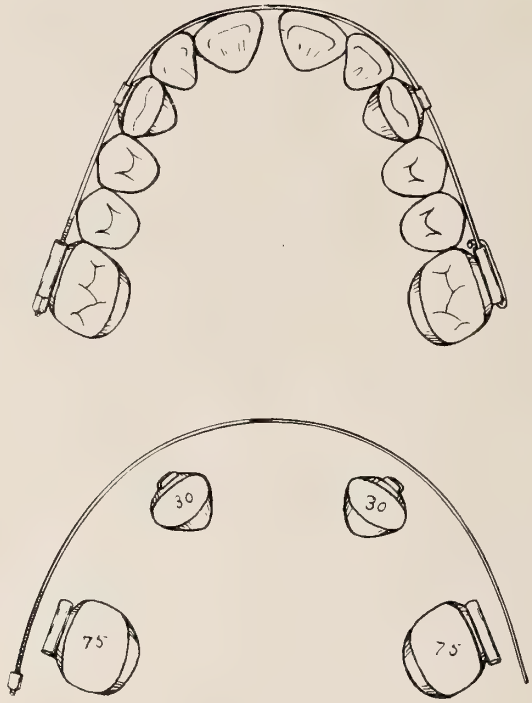
60.



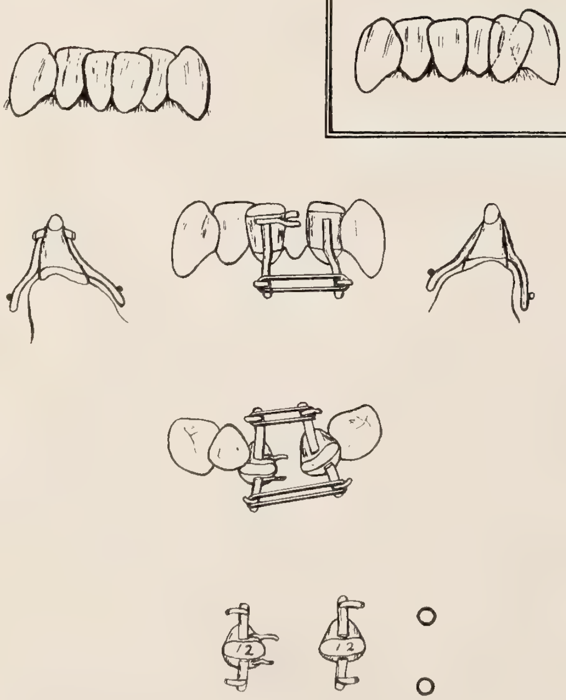
61.



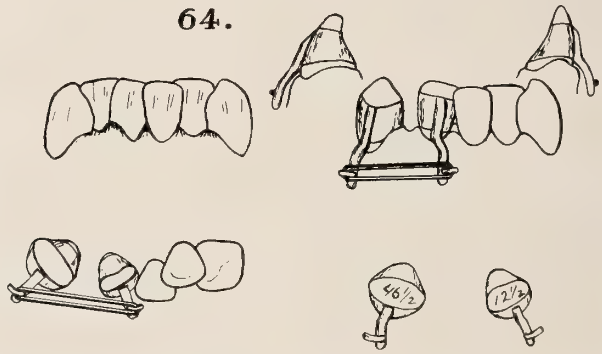
62.



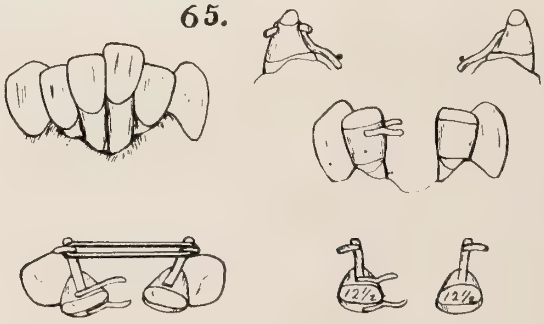
63.



64.



65.



of the upper and permit an opportunity for the muscles of the lips to aid in retaining these teeth in normal pose. If there are indications of deposits of seruminal calculi upon the roots of the affected teeth with symptoms of pyorrhea — a condition which quite commonly exists, whatever the real cause of the irregularity — this should be removed and such treatment continued during the operation as the case demands.

I have found that teeth which assume this special irregularity during adult life present the most continued opposition to retention after correction of any of the malpositions, even though the apparent local causes be wholly removed. This is especially true if the separation is between the central incisors and of long standing, and particularly if principally due to inheritance. In a number of instances of this kind after retaining appliances had been removed, which held the teeth perfectly for at least two years, the teeth soon showed signs of returning to their former positions; and with no apparent cause for it other than the unaccountable force of Nature. Therefore if we hope to correct this irregularity, which frequently mars the entire facial expression, and otherwise is exceedingly annoying to the patient, the proposition of permanent retention is an important factor. Inasmuch as it will require the retaining fixture to be worn indefinitely, the ordinary retaining appliances are objectionable. The retainer which I have used in these cases with the greatest satisfaction is in the form of a staple which, doubtless, has been used for years in various forms and positions.* When constructed according to the method described under the head of "Permanent Retention," p. 394, it is unseen from the front, and in lingual view is a small gold wire extending from the lingual fossa of one tooth to that of the other.

Apparatus 59, 60, 61, and 62

With the cause removed the closure of an abnormal space between the upper central incisors is usually not difficult. The entire malposition may often be corrected by bringing the centrals together with very simple means, and in retaining with the **staple fixture**. Bands with hook attachments for elastic or wire ligatures, as shown in **Ap. 60,** is the most common method; though it may be frequently necessary to supplement them with a light alignment bow. The employment of the lingual hooks act as a check to rotation movement; but there is no objection to encircling the teeth in an elastic ring, providing it be prevented with the proper attachments from working its way beneath the gingivæ. When a loop passes around two teeth in this way it should be made to hug the lingual surfaces of the teeth by tying a light ligature around the loop at the interproximate spaces.

For adults with long standing cases, **Ap. 61** will be found more effective and will give less pain and annoyance to patients than the ligatures. Frequently all of the labial teeth are involved in the malposition, requiring a contruding

*See the Dental Review, February, 1904.

as well as a mesial movement. This may be accomplished with **Aps. 59 and 62**, which are so well shown by the drawing they will need no explanation.

The Closure of Spaces Between Lower Front Teeth After Extraction

Overlapping and malturned irregularities of the lower incisors is one of the common forms of dental malposition. Usually this is caused by a lateral contraction of both arches, which demand expansion for correction. At times this irregularity will occur with the arches in normal width, the upper teeth regular, and the buccal teeth in normal occlusion, seeming to be due to the fact that the lower teeth are inharmonious in size in relation to the upper. If it is due to the fact that the lower buccal teeth are in slight mesial malocclusion, and the patient is young and the occlusion has not assumed a fixed position, the correction should consist in retruding the lower buccal teeth with the intermaxillary elastic force.

Crowded malalignments of the lower incisors are not uncommon with patients older than 35 years of age. This frequently arises from the same cause that produces the wide spaces between the upper centrals, i. e., the wearing down of the occlusal surfaces of the buccal teeth causing the jaws to come closer together, thus forcing the lower forward with a contraction of the arch.

The incisors being forced into malturned positions, close the interproximate spaces which are so necessary for the health of the teeth, and which frequently result in absorption of the tissues, pyorrhea, etc.

In these cases the demand for the extraction of a lower incisor is *imperative;* and if this is followed with a proper closure of the space and regulation, it will frequently be the means of saving the balance of the lower labial teeth in a healthy condition, which otherwise would succumb to the abnormal conditions with ultimate loss.

In closing the space caused by the extraction of an incisor preparatory to aligning the teeth, in the correction of an irregularity where this operation is demanded, the principal object is to avoid leaving an abnormally wide interproximate space which will usually occur with the ordinary inclination movement of the crowns.

A choice of the particular tooth to be extracted should be guided by the apparent relative distances of the apical ends of the roots from each other — everything else being equal — choosing that one if possible which is between adjoining teeth whose roots are nearest together. The common choice of a novice will usually be the tooth which is furthest out of alignment. More often than otherwise this is wrong, because in the natural inclination movement of the crowded crowns the root of the malposed tooth acts as a fulcrum, forcing the apical ends of the adjoining teeth further apart; and as the difficulties of correction lie mainly in the necessity of bodily moving the roots towards each other the extent of the root movement is of the greatest importance.

Apparatus 63, 64, and 65

This is well shown in the upper drawings with **Ap. 63.** If the left lateral which is far out of alignment is extracted, the movement of the roots of adjoining teeth would need to be considerable, to properly close the interproximate space, whereas by the extraction of the left central, correction might not require more than an inclination movement of the crowns alone. Opportunities to this extent however are not common, the usual conditions demanding a more or less bodily movement of the entire adjoining teeth.

By attaching a traction bar at the gingival margins, as in **Ap. 61,** an inclination movement will occur until a contact point of the crowns is reached, which then, if prevented from sliding by, will become a static fulcrum, the teeth becoming levers of the third kind with force and movement transferred to the roots. The mechanical advantage of the power will be increased in proportion to the relative lengths of the power arms, or to speak exactly, in proportion to the nearness to the apical ends to which the power is applied.

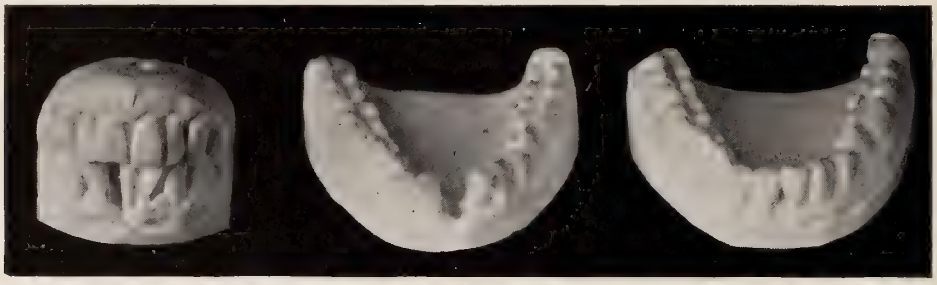
Fig. 12.

An effective method for closing spaces between lower teeth after extraction is shown in **Aps. 63 and 64.** To wide long-bearing bands fitted to the desired teeth No. 18 rootwise bars are soldered and shaped to lie close to the gum as shown. To the ends of these are soldered short T's for the attachment of rubber bands. To prevent rotation, which would naturally occur with force applied at so great a distance from the central axis of the tooth, the bars are attached to both the labial and lingual surfaces of the bands which enables one to govern the amount of this movement. If irritation of the tissues is caused by the unnecessary length of the bars, they are easily bent in a distal direction which is equivalent to shortening them. The fork attached to the occluso-proximal border of one of the bands will prevent the teeth from overlapping when they come into contact.

Apparatus 64 shows how the fork and lingual bars may be dispensed with

in those rare instances where rotation and inclination movement will correct. Fig. 12 shows the common results of a bodily movement of the incisors to close the space of an extracted tooth.

Fig. 13.



Apparatus 65, illustrated by the drawing, is that of a case in practice, shown in Fig. 13, which was made from the dental casts of a gentleman thirty-five years of age, whose lower incisors were affected with pyorrhea and with decided gingival and alveolar absorption, resulting in the necessary loss of the two centrals. The space was closed with the apparatus as shown and the disease was completely eradicated, terminating in a most satisfactory restoration of the surrounding tissues.

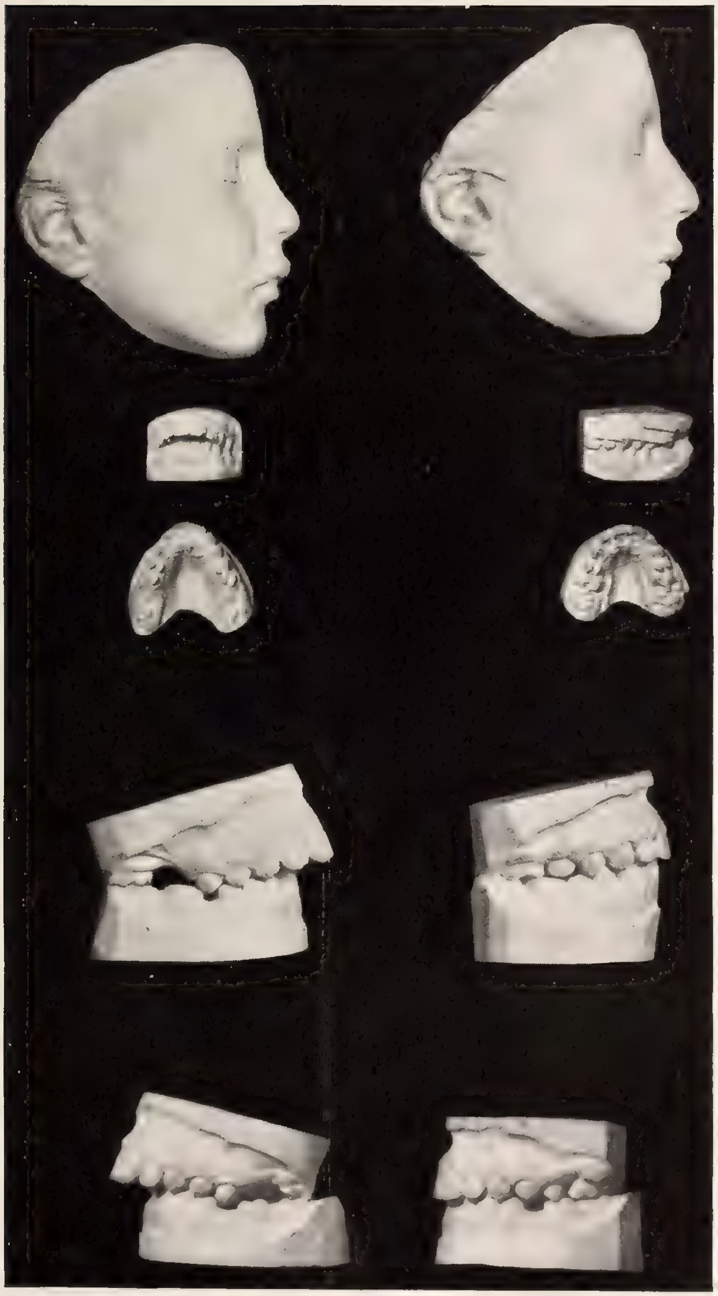
The Closure of Molar Spaces After Extraction

An interruption in the development of the crowns of the first permanent molars during dentition, is not so very rare. Nor is it rare to find the crowns of these teeth at 10, 11, and 12 years of age so broken down with the ravages of decay that their permanent preservation is questionable. When this occurs in a denture which shows by every indication that it is decidedly protruded in its dento-facial relations, the defective molars, instead of the bicuspids, should be unhesitatingly extracted and appliances placed that will close the wide molar spaces, by a bodily movement of the adjoining teeth. See Appliances shown in Fig. 56, Class V. The complete apparatus should be constructed also with a view to the final retrusion of the protruded front teeth, the force of which — it is needless to say — should be that of occipital and intermaxillary.

Fig. 14 was made from the casts of a patient 11 and 12 years of age. The four first molars were of the character mentioned. The lower molars were temporarily filled and the upper were extracted.

On the right of the upper illustration is imperfectly shown the distal appliance from impressions taken before their removal. The balance of the final impressions were taken immediately after removing the apparatus preparatory to placing the truing appliances to be followed with the retaining fixtures. It will be seen by the casts that the molar spaces are now completely closed without the slightest inclination of the adjoining teeth, and that the dento-facial protrusion has been wholly reduced.

Fig. 14.



CHAPTER XXII

GROUP VI. IMPACTED TEETH AND THEIR TREATMENT

The failure of certain permanent teeth to erupt long after their normal periods of dentition, and which lie imbedded wholly or partially in the alveolar process, have long been sources of unhappy conditions that demanded the highest order of skill to remedy.

Advantages of the X-Ray

Since the discovery of the Roentgen ray, many of the difficulties which formerly confronted the operator have been removed. The development and perfection of dental skiagraphy makes it now possible to determine with certainty the presence or absence of a missing tooth that is suspected of being impacted, and which gives no outward indication of its presence. The ordinary skiagraph will also give a very fair idea of the relative position and location of wholly imbedded teeth to any one who understands the peculiar shadow distortion which the ray is liable to throw upon the plate. This is a feature of considerable importance to one who desires to know the exact posture and the location of an impacted tooth, as will be seen later.

Occasionally the X-ray will expose certain causes for the impaction that would otherwise be unknown, which if removed will permit the tooth or teeth to erupt sufficiently at least to allow the attachment of force devices for its final adjustment in the arch. I refer particularly to supernumerary teeth and odontomata which are wholly imbedded in the process with the normal teeth and in such a manner as to obstruct their eruption, and which frequently give no outward appearance to the overlying gum that would indicate their presence.

Order of Impactions

In the author's practice, the teeth most liable to be impacted are, (1) the upper cuspids; (2) the lower second bicuspids; and (3) the upper central incisors. The third lower molars, however, are perhaps far more liable to become impacted than any of the other teeth; and the third upper molars, upper second bicuspids, and lower cuspids, are occasionally in this condition.

Dr. Cryer, in a paper published in the Dental Cosmos, January, 1904, places the order of frequency of impacted teeth as follows: (1) the lower third molars; (2) the upper cuspids; (3) the upper third molars; (4) the upper central incisors; (5) the lower second bicuspids; (6) the upper second bicuspids; and (7) the lower

cuspids. His opinion should receive respect, based as it is largely upon an examination of numberless clinical cases and dried skulls.

Causes

The common cause of dental impactions is the absence of room in the arch for their free and normal eruption. The spaces for the third molars, which are at present rarely more than sufficient in Caucasian races for the normal eruption and occlusion of these teeth, seem to be gradually diminishing through a foreshortening of the jaws under the forces of evolution. These spaces, moreover, which normally arise for the third molars in the final development and growth of the jaw, are doubtless frequently encroached upon by slight retruding movements of the buccal teeth, through the forces of mastication seeking occlusal interdigitation of the cusps. This may be one of the principal causes for the retarded eruption and impaction, especially of lower third molars, which are frequently crowded back under the angles of the ascending rami.

Fig. 15.

Two impacted canine teeth. (Cryer)

Fig. 16.

An impacted second premolar and a third molar. (Cryer)

In Chapter XI it will be seen that Dr. Cryer has pointed out the dangers of a *considerable* distal movement of the buccal teeth to correct occlusion, which has been recently advocated as an advanced step in Orthodontia, but one which could only be practiced in a thoughtless disregard of physiological demands in the normal eruption of third molars.

A frequent secondary, or concomitant cause for the impaction of lower third molars and other teeth is doubtless the deflecting influence of impinging roots of adjoining teeth, which the crowns of the erupting tooth come in contact with

at a time when, its roots being uncalcified, the crowns are easily deflected from their true perpendicular positions and growth movements. This turning of the crown from its true course, which with the upper cuspids seems to be caused by the roots of the deciduous cuspids, cannot well help but divert and misdirect the forces of resorption which are necessary for the growth movement of the tooth, and which tends always to project it along the line of its central axis. Moreover, the malposition which may commence at first with a slight deflection is probably further enhanced by the vis-a-tergo forces of eruption and development of the root. This would seem to be true in those frequent cases of impacted upper cuspids which lie imbedded nearly or quite parallel to the occlusal plane and with their crowns just back of the incisor roots; which would indicate that the malinclination had principally if not wholly occurred before the roots were developed, and that the resorptive, eruptive, and developing forces had all tended to carry the tooth forward along the misdirected line of its growth. See Fig. 15, (Cryer).

In a very large proportion of the impactions of lower third molars they lie in a decided mesial inclination, frequently parallel with the occlusal plane, and with their occlusal surfaces resting against the distal surfaces of the roots of the second molars and frequently with the points of the cusps locked in the disto-cervical depressions as shown in Fig. 16, (Cryer).

Fig. 17.

Inverted third molar. (Cryer)

In Fig. 17 is most perfectly illustrated one of the possibilities which may arise with impacted third molars.

When **first lower molars** are naturally or artificially retruded at an early age, the crowns of the second molars, whose roots may not be wholly calcified, are pressed back with an inclination movement. It would seem, in this distal movement and inclination of the second molar, that the overhanging distal surface of its crown and root, impinging and pressing down upon the mesio-occlusal angle of the third molar crown, which at 12 years of age lies imbedded in the apical zone without roots, and with its crown already mesially inclined, would tend to hold it down at that point, while the eruptive forces would tend to lift the distal portion of the crown and turn its occlusal surface forward against the second molar. The ultimate calcification of its roots in that position causes them to extend back beneath the angles of the rami, with an impaction of the tooth which often demands a severe surgical operation for its removal. If at 8 or 9 years of age the first lower molars are forced back half the width of a cusp, as has been recommended for

the purpose of attaining a typically normal occlusion, the unerupted second molars, whose roots at that age are uncalcified, are doubtless moved distally to an unnatural position in the jaws. If held in that unnaturally retruded position, it is not strange that the mesio-occlusal portion of the partially developed crown of the third molar should be projected forward beneath the growing roots of the second molar, and thus prevented from following the natural course of its eruption to an upright position, with the production of an impaction that would not otherwise have occurred.

Dr. C. N. Pierce, on p. 646, Vol. III, American System of Dentistry, truly says: "An impacted third molar at the base of the coronoid process is capable of giving as much excruciating and persistent suffering as is possible for human nature to endure. Indeed, there is no abnormality or mission coming in the province of the oral surgeon which demands more prompt action, or for the time more thoroughly taxes to the utmost his best judgment and skill. The removal of the anterior molar is often indicated for the purpose of giving relief; indeed, when the third molar is imbedded so that it cannot be reached, it is the only remedy." This in the practice of Orthodontia should be well considered before blind and thoughtless attempts are made to apply the intermaxillary force to the teeth of youths of tender ages, in a frantic endeavor to produce a typically normal occlusion in cases of inherited disto-mesial malocclusions.

In a paper read before the Chicago Dental Society, January, 1905, entitled "Impacted Teeth, Their Liberation and Correction," the author exhibited twenty-nine cases comprising thirty-seven impactions. Of these a few of the most interesting are selected to illustrate this chapter. Of the impactions **eleven** were upper cuspids; **six** were upper central incisors; **ten** were lower second bicuspids; and **one** was an upper second bicuspid.

Of the **cuspids,** eight were accompanied, up to the date of presentation, with the preceding deciduous cuspids, nearly all of the roots of which were not decalcified. It may be that the roots of deciduous cuspids, which from some cause the resorptive forces do not attack, are the principal cause of the impaction of cuspid teeth. Again, the deflection of the crowns may originally arise from some other cause which enables the projecting forces of growth to carry them so far to one side that the decalcification of the deciduous root does not occur. Thus the deciduous cuspids not being shed because of the unabsorbed roots, and remaining firmly seated in their alveoli, are probably allowed to remain because of the doubt which arises as to the presence of the permanent cuspids, which only the X-ray is able to definitely determine.

Two of the **cuspid** impactions were caused by the presence of supernumerary lateral incisors, and one by the premature loss of the deciduous cuspid which permitted the adjoining teeth to close the space.

Of the impacted **central incisors,** four were caused by the presence of supernumerary teeth, and two by odontomata.

Of the impacted **lower second bicuspids,** ten were caused by the premature loss of the second deciduous molars, and one by the delayed extraction of the second deciduous molar. The last character is quite commonly observed by dentists. In the thirty-five years of the author's private and clinical practice, no less than fifteen cases of impacted lower second bicuspids from this cause alone have presented. When a second deciduous molar is not thrown off by the eruptive forces of the second bicuspid, the growth and crowding nature of the adjoining buccal teeth will cause their crowns to overhang and entrap it in their dovetailing inclinations until it is forcibly extracted. If, as in all cases of this character which I have observed, the roots of the deciduous molars are completely decalcified, it is not difficult to force the crowns out through the buccal or lingual interproximate spaces — the impacted bicuspids being found immediately beneath. In this connection it is interesting to note the difference in the growth altitudes of the deciduous and advanced permanent occlusal planes.

Treatment

In all cases where the impacted teeth are necessary for the perfection and preservation of the dental arch, every means should be employed to restore them to their normal positions. The treatment should consist, first, in a removal of the causes and all obstructions to their free eruption. Where adjoining teeth partially or completely close the space, the proper appliances should be attached for widening the space and retain it until the position of the impacted tooth is corrected. **Deciduous, and supernumerary teeth, and odontomata,** should be removed, and the overlying gum and process freely cut away so as to expose, at least the occlusal portion of the crown. If the tooth is imbedded deeply in the process it may require several operations to keep the wound open. The inflammation that ensues is advantageous toward a stimulation of the eruptive forces, which having lain dormant for years are slow to be aroused to renewed activities of tooth growth. During adolescence, after the obstructions to the growth of impacted teeth are removed and the channels of eruption kept open, without other aid they will usually erupt to a sufficient degree at least to enable the placing of lightly attached bands or caps arranged for the attachment of rubber ligatures to co-operating appliances. If the tooth is found to be much out of position or decidedly malturned or inclined, more firmly attached bands can be placed later to permit the application of positive forces.

With older patients it may be found impossible to arouse natural growth movement; or the position and inclination of the impacted tooth may be such that the propelling direction of its growth movement is of little use, even if possible. In either event, means for the application of artificial force will be found necessary; and as its position precludes the possibility of a band attachment, a small pit may be bored into the crown to attach a hook for a rubber ligature. But this

should never be attempted until the crown is sufficiently uncovered to determine the relative position of the tooth and the exact anatomical area of the exposed surface, in order that the hole be bored at some point on its lingual surface that will not ultimately deface the tooth when filled, and particularly to avoid endangering the vitality of the pulp.

With impactions of the labial teeth, to which these precautions only apply, the position of the pit should be chosen on the lingual surface of the crown, at a point so that the drill may be directed safely as regards the pulp, and, if possible, at right angles to the direction of the required force, in order that only a moderate depth will be necessary to insure the stability of the post hook. The choice of position may also be influenced by the possibility of the force producing an unnecessary or necessary rotation of the tooth in its movement to place.

With teeth that are so deeply imbedded that a visual examination is not possible, these requirements often demand a most careful and intelligent indirect digital diagnosis, with an instrument calculated to sensitively impart the character and anatomical conformation of the freed area.

Fig. 18.

Fig. 18 illustrates the common appliance employed for hastening the eruption of completely imbedded teeth. The adjoining teeth are banded, and a bar is soldered from one band to the other so as to take a position at the extreme occlusal zone. This acts as a retainer where the space has been widened and as a means for attaching elastic bands to the impacted tooth. The hole that is bored into the tooth for this purpose need not be deep if it takes the proper direction.

The drill for boring the hole, and the wire which should exactly fit it,— with no attempt to screw it in — should be about No. 19 or 20. In placing and forming the hook, use a straight piece of wire about five inches long, well annealed

Fig. 19.

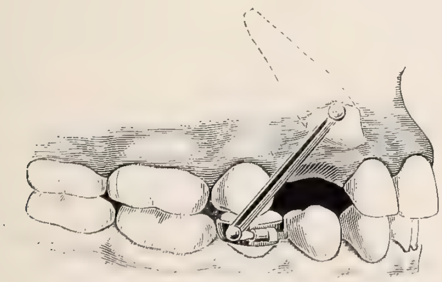
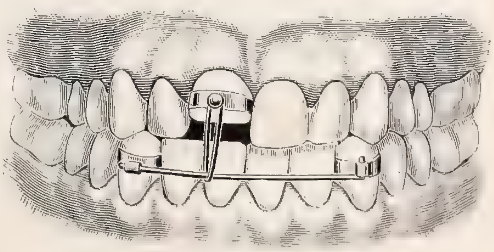


Fig. 20.



at the attachment end. After cementing in place, cut the wire off, leaving sufficient length to bend it close to the surface of the gum and opposite to the direction of force. This will cause the rubber ligatures to hug the tooth and thus exert little force upon the wire attachment to dislodge it. When the impacted tooth has

been forced out of its imbedment sufficiently to enable the attachment of a band, it will commonly require another appliance to place it in normal position.

A more forcible action of the elastics may be obtained by attaching them to the teeth of the opposing jaw. Figs. 19 and 20 illustrate an ingenious and effective method which was proposed by Dr. E. H. Angle in 1891. As early as 1868 Dr. Jerry A. Robinson of Jackson, Michigan, employed this same principle, using silk ligatures instead of rubber, by tying them to the necks of the teeth, in a case quite similar to Fig. 20, for a young man living in his family. The traction ligature was removed at meal times. The correction was accomplished in a short time, and retained by tying the ligatures to adjoining teeth.*

Dr. Angle would probably not advocate to-day the boring of a hole in the face of a cuspid as shown in Fig. 19. When a band or lightly attached cap with a hook attachment cannot be secured to a tooth, a hole can usually be bored for a pin at a point where it will not ultimately be a defacement. On p. 41, under "Construction of Regulating Bands," is described the method of banding partially erupted cuspids.

The Impaction of Second Bicuspids

Fig. 21 shows casts and skiagraphs of a boy of 14 years of age. The premature loss of the second deciduous molars had permitted the adjoining teeth to completely close the space for the second bicuspids, as shown by model "A."

Fig. 21.

* The author, who was a student of Dr. Robinson's during the time of the above operation, was told that this was the common method of correcting the position of "short teeth." From this it may be seen that direct intermaxillary force was employed in dentistry much earlier than has been supposed.

The accompanying skiagraph shows the impacted bicuspids. The proper appliances for opening and retaining the space and correcting the malocclusion were attached, which caused the impacted teeth to erupt as seen in model "B." This case practically illustrates the common cause and results of impaction of this character.

Impaction of Upper Cuspids

Fig. 22 is from the casts and skiagraphs of a girl 14 years of age. In an examination of cast "A," which represents the case when presented, there will be found no abnormal prominences of the gum surface to indicate the presence of the permanent cuspids.

Fig. 22.

It is important to note in this and other cases to be shown, the shadow distortion of the position of the impacted teeth which the ordinary skiagraph is liable to produce. Here they have the appearance of lying imbedded in the process at an inclination of 45° as compared to the normal, and with the apical ends of the roots quite distally located.

In cast "B," which shows the cuspids as they naturally erupted after the removal of obstructions, and cast "C," after their malpositions are corrected, they are seen to be in perfect inclination in relation to the normal, a position which they could not have attained had their roots been located as indicated by the skiagraph. This is far better shown by the cast of this case.

Fig. 23 is from casts of a gentleman about 25 years of age. Slight prominences of the gum surface indicated the presence of the impacted cuspids. The

skiagraphs also give to them the appearance of quite a mesial malinclination, which their erupted positions, shown by cast "C," by no means confirms. It would have been impossible to have turned these teeth to the nearly or quite normal inclinations, shown by the cast, had they been imbedded in the process in the position which the shadow distortion of the X-ray shows them. In this case the projecting force of eruption has carried the points of the crowns well forward toward the lingual aspect of the central incisors, demanding quite a decided distal movement in lifting and forcing them into alignment. One of the hooks for the attachment of the elastic force is shown on the right cuspid of cast "B," just as the tooth is emerging from the gum. Cast "C" shows the cuspid sufficiently erupted to place bands for the attachment of the lingual reciprocating jacks for the final rotation and lateral movement of the crowns into alignment.

Fig. 23.

Fig. 24, illustrates the case of a girl 16 years of age. Two fairly well formed upper laterals and no cuspid on the right side are shown in the beginning casts "A" and "B." No prominence of the gum indicated the presence of the missing cuspid. The supernumerary lateral is plainly located, as the one next to the central, by its larger size and slight difference in shape as compared to the other two

Fig. 24.

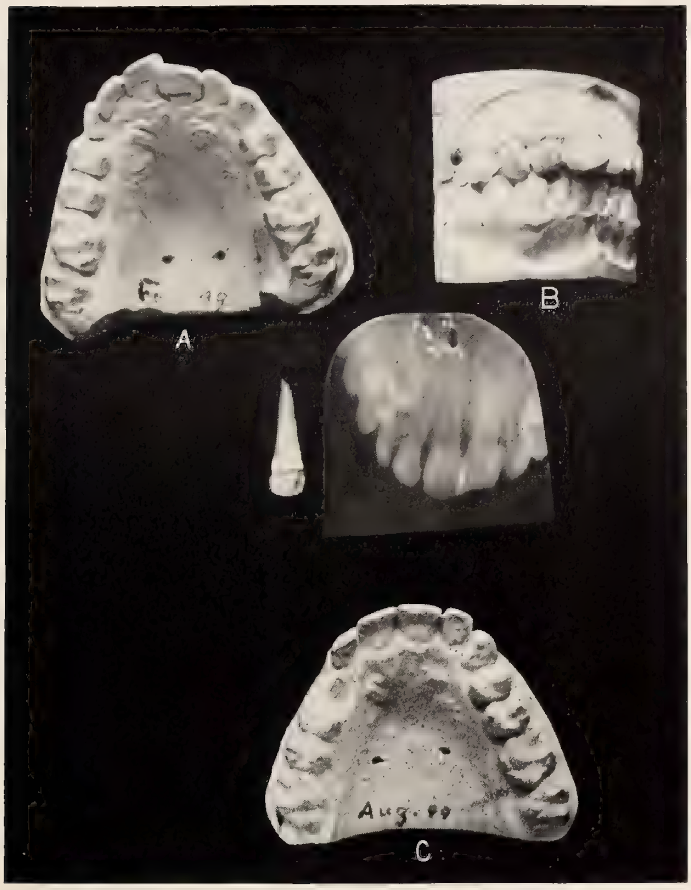


Fig. 25.

laterals. Notwithstanding the fact that the supernumerary lateral was badly disfigured by a yellowish channel across its labial face, shown by the preserved tooth and cast, not one of the good dentists who cared for her teeth thought to look for an impacted cuspid by the aid of the X-ray, now shown by the skiagraph. As shown by cast "C," the supernumerary was removed, the distally located lateral was forced forward to place, and the impacted cuspid, now in a partial state of eruption, is ready for the final adjustment.

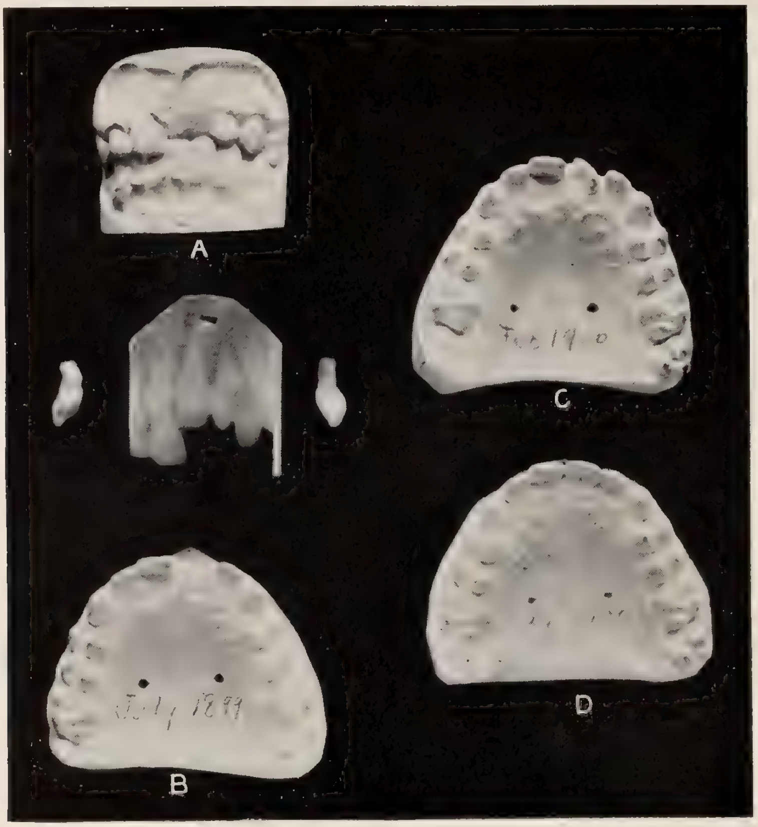
Impaction of Upper Central Incisors

Fig. 25, illustrates the case of a girl 14 years of age Cast "A," made from impression at presentment, shows no prominence of the gum surface to indicate the presence of the missing incisors. The skiagraph shows the two central incisors above, and also two impacted supernumerary teeth imbedded below them. Below these is seen the right lateral which marks the occlusal

plane. The skiagraph plate, unfortunately, was cut too narrow to show the left lateral. The extracted supernumeraries are seen on each side of the skiagraph. Cast "B" shows right incisor in partial state of natural eruption and the left incisor ready to burst through the gum.

Fig. 26 shows casts, etc., of a boy 13 years of age. Casts "A" and "B" represent the appearance of the case when presented. The linguo-incisive alveolar ridge is somewhat prominent but hardly sufficient to assure the presence of the missing incisor, which is seen in the skiagraph wedged between two impacted

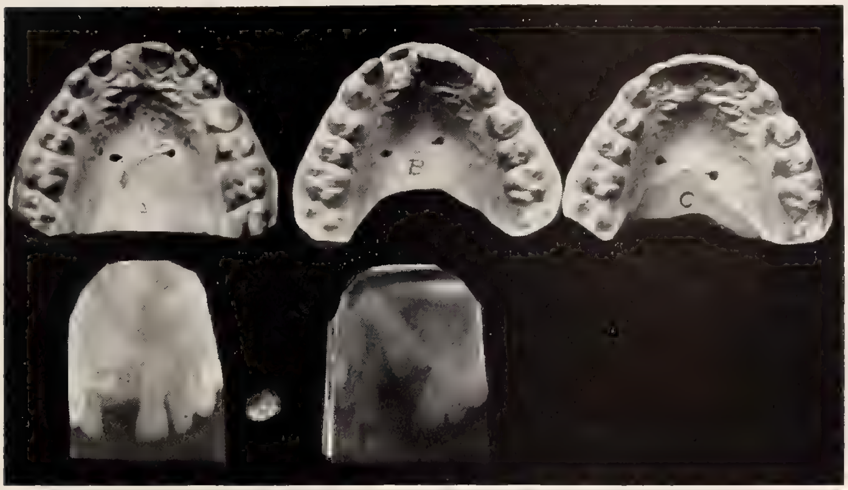
Fig. 26.



supernumerary teeth. The latter were extracted and are now shown on each side of the skiagraph. Cast "C" shows the incisor in a partial state of natural eruption after the obstructions were removed. At this time band appliances were attached for the regulation, with a final result shown by cast "D."

Fig. 27, shows casts, etc., of a boy of 17 years. Cast "A" and skiagraph on the left shows dental arch and location of the impacted incisor. By carefully observing the latter, the shadow of a small dense body is seen to lie at the incisal edge of the impacted tooth in the pathway of its natural eruption. This proved to be an **odontoma** about half the size of an incisor crown which was loosely imbedded in a partially absorbed area of the process. Having no power of its own to erupt and composed of a structure that resisted the resorptive elements, it remained as

Fig. 27.



a permanent obstruction to the pathway of natural growth of the impacted incisor. Its irregular surface studded here and there with enamel prominences demonstrated at once its general tooth structure. The patient living out of the city, I was unable to see the case for a year after the first operation. As the tooth at this time presented no signs of erupting, the second skiagraph on the right was made, which shows the incisor at a somewhat advanced stage, but evidently retarded in its growth by dormant physiologic processes or obstructed by the overlying secondary dense tissues which closed the original wound. This was freely removed as before. In another year the case again presented with the incisor sufficiently erupted, as shown by cast "B," to attach a band and appliances for its final correction, as in cast "C."

Fig. 28.

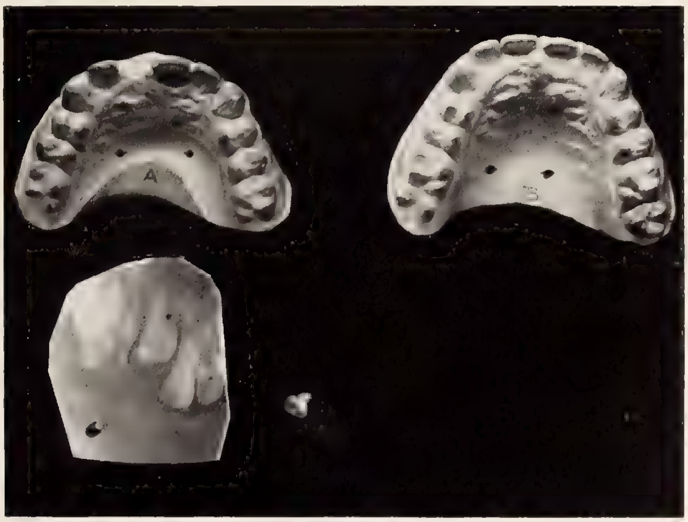


Fig. 28 was made from the skiagraph and casts of a girl, 16 years of age at presentment. The surface of the surrounding gum, as shown by cast "A," gave no indication of the impacted incisor, which in the skiagraph is seen to be

interrupted in its physiologic eruption by an odontoma located at its mesio-incisal edge. This was removed — with the overlying process — and can now be seen at the right of the skiagraph. About one year afterwards — during which time there were several minor operations to remove obstructing tissue — the tooth was sufficiently erupted for the attachment of a band, which enabled a rapid correction as shown by cast "B."

Let us hope that familiarity with the advantages presented by the possibilities of the X-ray will lessen the number of cases of unnecessarily lengthy dental impactions after the usual ages of normal eruption.

PART V

Practical Treatment of Dento-Facial Irregularities

CLASSES OF DENTO-FACIAL IRREGULARITIES

Class I. Maleruption of Cuspids — three types

Class II. Protrusion of the Upper Teeth with Lower Normal — five types

Class III. Retrusion of the Lower Teeth with Upper Normal, and Upper Protruded — four types

Class IV. Retrusion of the Upper Teeth with Lower Normal, and Lower Protruded — five types

Class V. Bimaxillary Protrusion

Class VI. Bimaxillary Retrusion

Class VII. Open Bite Malocclusion

DENTO-FACIAL IRREGULARITIES

CHAPTER XXIII

DENTO-FACIAL HARMONY

In the diagnosis and treatment of all dental irregularities which produce inharmonies in the facial outlines a mental standard of comparison is imperative. The ability to establish a mental standard of beauty should not be confined to a fixed idea of the facial outlines of classic art as shown in that of the Apollo-Belvedere, but it should be one which may at times be adjusted in the mind's eye to the different types of physiognomies which present for treatment, according to the rules laid down in the Chapter on Diagnosis. Thus the most desirable outlines of the dento-facial area which it is possible to produce in the correction of dental irregularities may be determined.

Fig. 1.

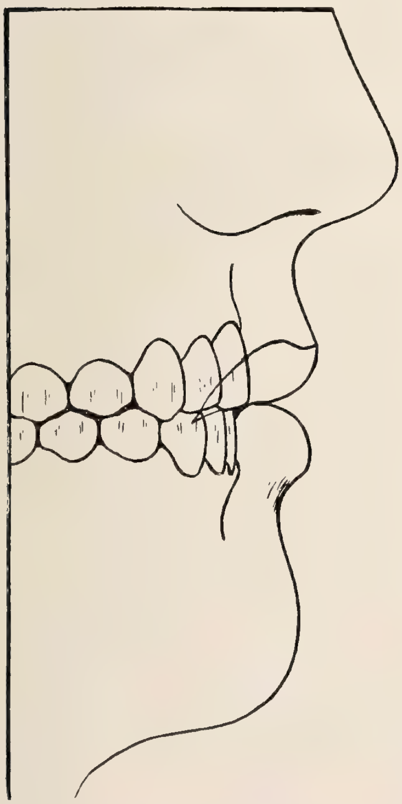


Fig. 1 represents the common relations which the lips sustain to the teeth in normal dento-facial position and occlusion. This figure will be employed throughout this division as a standard of comparison solely for the purpose of showing the probable degree of inharmonies in the facial outlines with different characters and types of protrusions and retrusions of the teeth and jaws.

In a normal occlusion of the teeth, as defined and illustrated in Chapters X and XI, the condyles of the mandible rest in their most posterior positions in the glenoid fossæ, while the incisal edges of the lower labial teeth pass slightly back of those of the upper.

The labial teeth and all of that portion of the adjoining osseous structure which it is possible to move with dental appliances attached to these teeth, constitute the main framework of the **dento-facial area**. And while no mathematical rules can be laid down as a standard of facial beauty because of the variety of different types that are denominated as "beautiful," it is nevertheless true that certain standards of physical relation must always obtain with every

physiognomy which lies within the field of what is termed beauty and esthetic perfection.

As the chin should always be sufficiently prominent in relation to the lower lip to produce no suggestion of a "receding chin," the antero-posterior relations of the lower teeth to the mandible — upon which this portion of the facial outlines depend — should be such as to bring into decided evidence the graceful concave curve of the labio-mental depression. The normal closure of the lower labial teeth, slightly back of the upper labial teeth, permits the desired esthetic harmony in the relations of the upper and lower lips. If, therefore, the upper labial teeth in arch alignment are not protruded or retruded in relation to the bones which form the framework of the middle features of the physiognomy, the upper lip will also assume the desired form and pose in relation to the cheeks, malar prominences, and bridge of the nose, which is necessary for the perfection of this portion of the facial outlines.

To complete the esthetic requirements of this *ensemble* of dento-facial harmony, the perfect ease and pose of the lips when closed and at rest is largely dependent upon the harmony in distance between the upper and lower jaws when closed, in relation to the labial and buccal tissues. If a long or an open bite malocclusion prevents the jaws from assuming harmonious relations in this regard the effort to close the lips, even when the teeth are not protruded, will mar the ease and perfection of their pose, with a frequent obliteration of the labio-mental curve and a retraction of the surface contour of the chin. See Figs. 59 and 60, p. 358.

On the other hand, if the closure of the teeth causes the jaws to come too closely together, as in short and close bite malocclusion, the redundancy of labial and buccal tissue is evidenced by the pouting attitude of the lips and other concomitant inharmonies to the facial outlines. See Fig. 27, p. 323. In this connection it would be well to remember that in all normal conditions when the features are in unconscious repose with the lips closed, the teeth are rarely, if ever, in occlusion, as the relaxed muscles more restfully sustain the mandible with the teeth slightly apart. Again it is very important in dento-facial orthopedia that rules which are acknowledged as the standard of esthetic beauty with adults should never be strictly applied to the facial outlines of childhood and early adolescence without an intelligent recognition of the developing influences of growth.

CLASS I

MALERUPTION OF THE CUSPIDS

Table of Types

Type A. unilateral maleruption of the cuspids

Type B. bilateral maleruption of the cuspids,—corrected with a normal occlusion

Type C. bilateral maleruption of cuspids,—corrected after extraction

---

CHAPTER XXIV

CAUSES AND GENERAL DIAGNOSIS OF CLASS I

By far the most frequent of Classified Irregularities of the teeth is that which is characterized by a maleruption of the cuspids. The most common characteristic of this class is that of a labial eruption of the upper cuspids. While this condition will frequently be found with both the upper and lower dentures, it far more commonly occurs with the uppers alone. If in these cases it is accompanied with an irregularity of the lower, it will usually be a malalignment of the incisors with the cuspids more or less prominent, though fully erupted. The reason for the more frequent maleruption of the upper cuspids as compared to the lower is principally due to the earlier eruption of the lower cuspids, which permits them to take their positions before the loss of the deciduous molars and the eruption of the bicuspids. It is also due to the fact that the temptation to prematurely extract the lower deciduous cuspids, to correct a seeming irregularity, does not arise as frequently as with the upper.

While Class I deals with the upper denture alone, it should be remembered that the methods and principles of movement which are here described are in the main equally applicable to like conditions upon the lower. Where variations are demanded, on account of interference with the tongue, the appropriate appliances will be found in the Simple and Complex Division.

There are a number of distinct variations in this class whose treatment differs quite radically, and which can only be truly determined by a careful and intelligent consideration of dental and dento-facial relations.

Causes

In a large majority of cases the position of the malposed cuspids is caused by the premature loss of the deciduous teeth, permitting an abnormal mesial move-

ment of the buccal teeth with more or less retrusion of the incisors, partially or completely closing the cuspid spaces. (See Fig. 30, p. 155.) Not infrequently is it caused by a failure of the superior maxillary to properly develop, due to early naso-maxillary diseases, thus crowding the teeth into an abnormally small arch before the eruption of the cuspids. In nearly all cases the abnormal contraction of the upper arch will have forced the lower teeth into malalignment, demanding in correction a concomitant enlargement of the lower arch to correct the occlusion and insure retention.

In some instances the mesial movement of the buccal teeth will amount to a complete jumping of a cusp and a perfect malinterdigitation. (See Fig. 32, p. 156.) Occasionally, this mesial malocclusion of the upper buccal teeth is partly or wholly due to a natural or inherited protruded position of the buccal teeth, the cuspid spaces being partly or completely closed in these cases by a retrusion of the incisor teeth, permitted by the premature loss of the deciduous cuspids, and brought about by the muscular action of the lips, — while little or no mesial movement of the buccal teeth has taken place. This retrusion of the incisors entrapping the cuspids has prevented the case from, perhaps, assuming a typical upper protrusion. I say "perhaps" because it should be remembered that in all of these cases the same rule obtains in regard to the dento-facial relation of the buccal teeth in malocclusion as in other irregularities. In other words, the dento-facial relation of the buccal teeth with the uppers fully the width of a bicuspid in mesial malocclusion, may indicate a typical upper protrusion; a partial protrusion of the uppers and a partial retrusion of the lowers; or a typical retrusion of the lower teeth. See Classes II and III. These principles are well defined and illustrated in Chapter XV.

Particular attention is called to these facts to show the need of an intelligent diagnosis, based upon dento-facial relations and not upon occlusion alone, in all irregularities of this class, as in all classified irregularities.

Important Considerations.— To determine the important question of dento-facial relations, the reader is directed to the chapter on **Diagnosis,** and especially to p. 179 (Practical Diagnosis). An epitome of the essential first steps are: (1) Relations of the chin to the unchangeable features. If that be correct, (2) the relations of the lower lip and lower teeth to the chin. If they be correct, their positions may be properly regarded as in normal dento-facial harmony, and (3) upon this basis the malposition of the upper teeth can be determined and the proper treatment outlined.

It is important to determine whether the malocclusion of the buccal teeth is due to local or constitutional causes. If from local causes and the disto-mesial malocclusion is only half the width of a cusp there should be no hesitation in retruding the upper buccal teeth to normal occlusion, even after the eruption of the second molars and in many cases after the crest of the cusps have passed their normal boundaries. But if from constitutional causes, after the full erup-

tion of the second molars and with no retrusion of the lowers, the propriety of extracting the second bicuspids should be considered, rather than attempt to retrude all the buccal teeth one-half the width of a cusp or more to an **unnatural** position in the jaw.

Again, if the malocclusion is fully the width of a cusp and in perfect masticating interdigitation, whether from local or constitutional causes, the extraction of the first bicuspids will be indicated, unless the mesio-distal malrelation is due largely to a retrusion of the lower teeth.

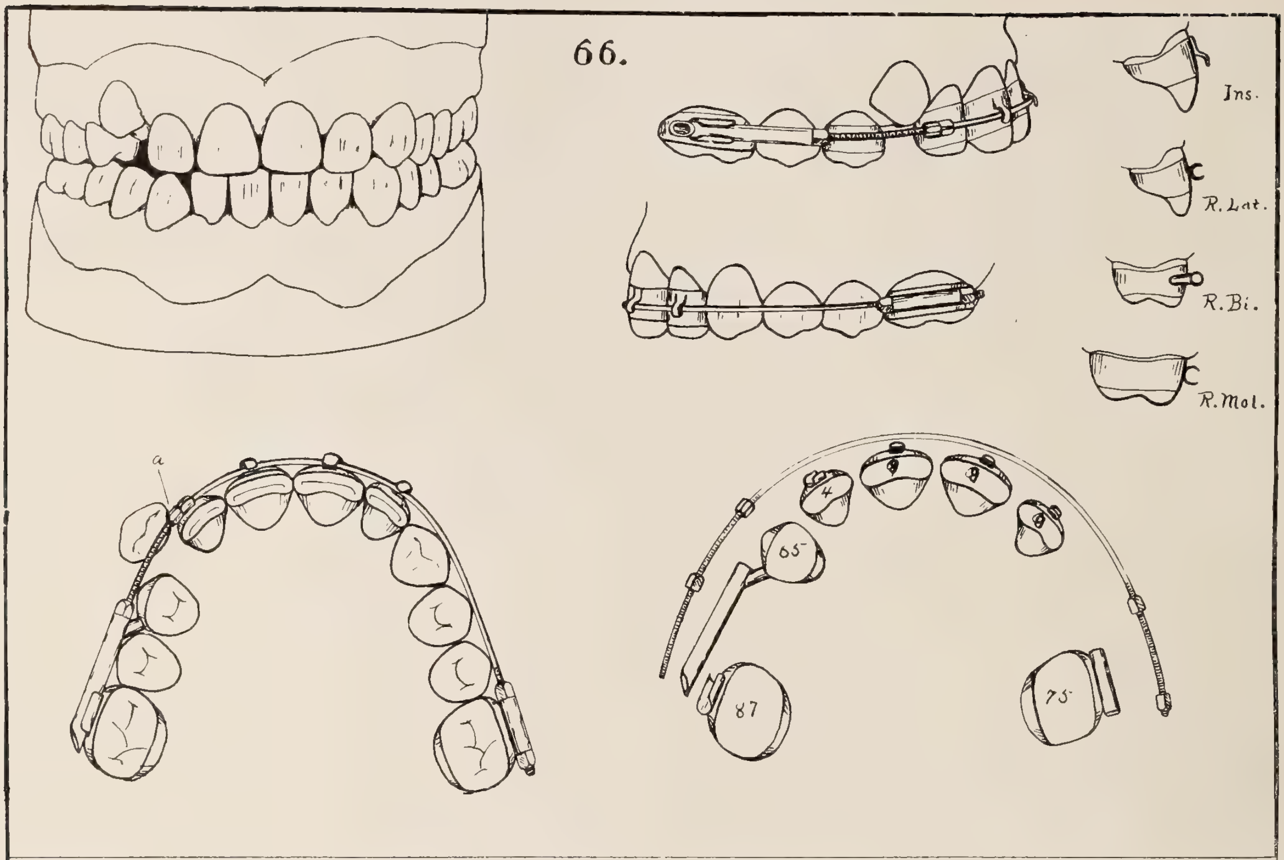
Relative to Extraction.— Such a very large proportion of this class of irregularities arise from local causes, demanding a general enlargement of the upper and lower arches to make room for the cuspids and perfect the occlusion, the extraction of teeth should never be indulged in as an aid to the *process* of correction, but always as a **dernier resort** when convinced that it is demanded for the greater perfection of occlusion, dento-facial harmony and final retention.

It perhaps is needless to say in this age of advancement, that the extraction of cuspids or lateral incisors is not only never excusable, but should be considered malpractice.

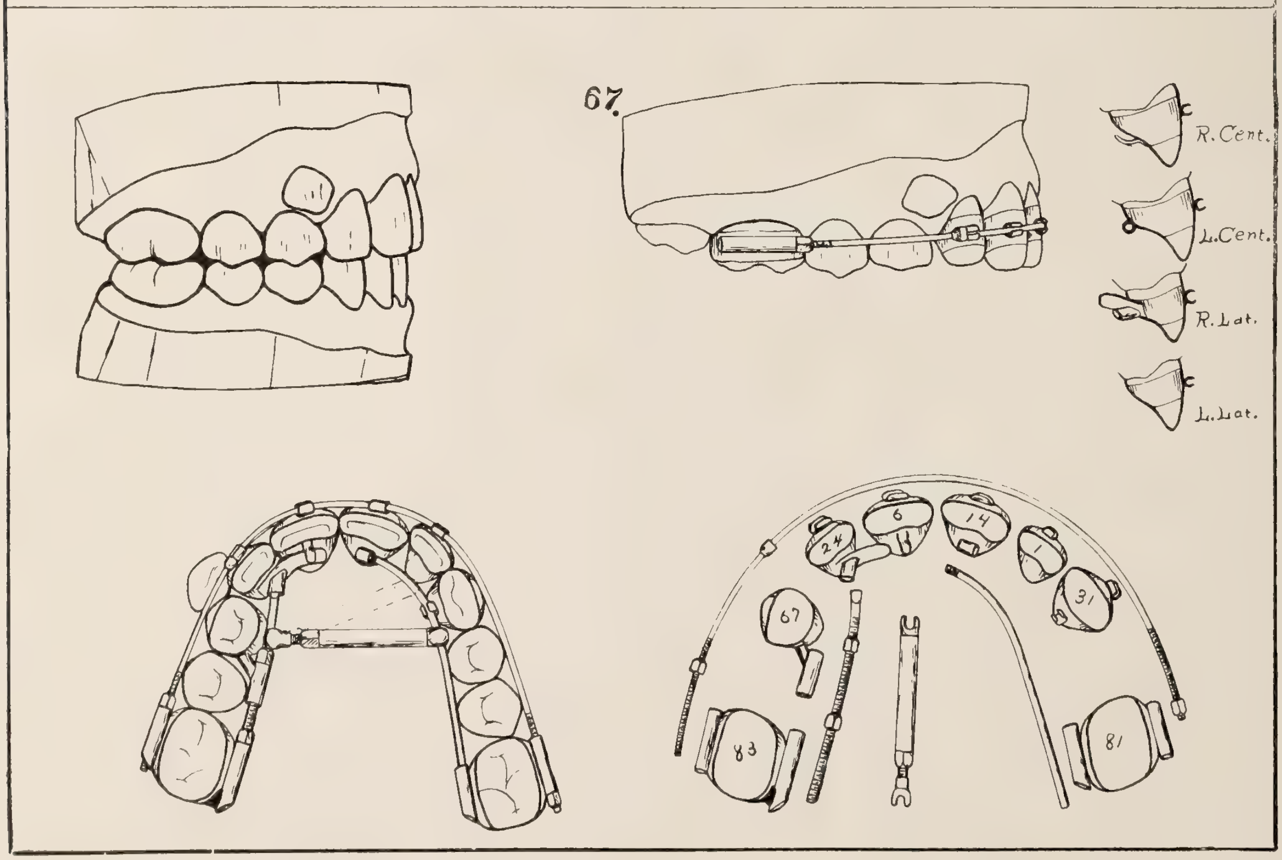
Many dentists who exercise good judgment in regard to most things will unhesitatingly extract the first bicuspid for young patients whose cuspids are crowded into a maleruption, with the belief that by making room in this way for the cuspids to properly erupt, they have accomplished the only sensible and non-troublesome operation. This very malposition of the cuspids may have been caused by these self-same dentists injudiciously extracting the deciduous cuspids to permit a freer eruption of the incisors; or in not saving the deciduous molars, which is quite as important during the time of their functional career as the saving of permanent teeth. If over-zealous dentists would view these conditions from the broader standpoint of future relations sure to be brought about in the developing and enlarging influences of growth, and consider the importance of a normal occlusion of the teeth and the retention and preservation of means to that end, they would be rendering the only true professional service that would redound to their credit and the future good of their little patients. Many instances can be shown where the injudicious extraction of the first or second bicuspids, or the first molars, for young patients, had caused an inharmony in the sizes of the arches and a malocclusion impossible to correct without either the extraction of bicuspids from the lower arch, or the opening of space on the upper, for the insertion of artificial teeth. See an account of a case illustrated with Fig. 28, p. 150.

Important principles relative to the treatment of this most common class of irregularities will be found in Chapter XIV.

66.


Ins.
R. Lat.
R. Bi.
R. Mol.
a
65
87
75

67.


R. Cent.
L. Cent.
R. Lat.
L. Lat.
6
14
24
1
31
67
83
81

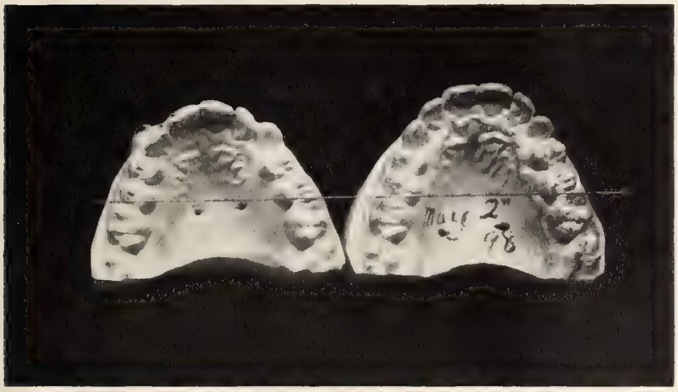
CHAPTER XXV

Type A. Class I

UNILATERAL MALERUPTION OF THE CUSPIDS

When an upper cuspid is prevented from properly erupting because of a partial closure of its space, it will frequently be impossible for it to ever align itself unaided through the natural influences of growth, because of the general contraction of the arch from causes that continue to exert their influence, even to driving the lower teeth into malalignment.

Fig. 2.



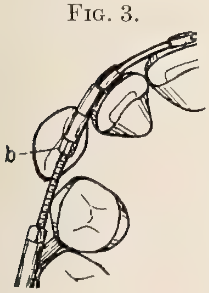
A **unilateral irregularity** of this type is often more difficult to properly correct than one that is **bilateral** because of the greater skill and peculiar application of force required to keep the arch in symmetrical form.

Fig. 2 shows a practical case in which the cuspid space was entirely closed. The contraction of the upper arch had contracted the lower, crowding the teeth into malalignment, demanding a concomitant enlargement of the lower arch with that of the upper.

Apparatus 66

Ap. 66 is well calculated for regulating slight unilateral irregularities of this character. One end of the **arch bow** No. 19 rests in a **buccal T-tube attachment** on the bicuspid (**B. 65**), the distal end of which is supported in a molar **open-tube attachment** (**B. 87**); the combination being calculated to promote a distal inclination movement of the buccal teeth. See Movable Anchorages, p. 91. The other end of the bow is adjustably fastened with two nuts to the left molar **tube attachment** (**B. 75**). The bow carries a fixed **lug tube** "a," soft-soldered at a point to engage with an **open-tube** attachment on the lateral band. Instead of the lug "a," the thread of the bow may extend mesially to carry another nut, — as in the disassembled apparatus, — to engage with the lateral through the medium of **sliding tubes,** as shown in Fig. 3. This combination permits lessening the direct stress upon the lateral by unscrewing the **lug-nut** "b," with a distribution of the protruding force of the bow upon all the incisors.

Fig. 3.



The incisor bands with **hook or open-tube attachments,** clasp the bow to force the teeth forward with its movement. Should one or more of the incisors be so far in lingual malalignment that the bow cannot be sprung into the attachments at first, or should they be slightly malturned, place **bands 6 or 7½** for wire or silk ligatures to force them to place.

The expanding force of the **nut** at the mesial end of the **bicuspid tube** forces the incisor teeth forward and to the left, with the bow. The lateral movement of the incisors can be aided or prevented by a pull or push movement of the bow at its left anchorage. The reaction of the protruding force will tend to retrude the right buccal teeth to normal occlusion by virtue of the free inclination action of its peculiar attachments. See Movable Anchorages, p. 91. If it does not fully accomplish this — as might occur in **Ap. 67** — the **intermaxillary force** will be indicated.

Apparatus 67

When the cuspid space is more completely closed and the arch proportionately contracted, a greater degree of expanding force for the general enlargement and symmetrical expansion of the arch will be demanded.

In **Ap. 67** the **arch bow,** Nos. 19 or 20, with **fixed lug** or **nut** to engage with the right lateral, is principally for the purpose of alignment, to keep the arch in symmetrical form, and aid in the correction of minor malalignments, etc. It, however, aids in the distal movement of the buccal teeth by acting directly upon the molar. The lingual appliance is unique in its adaptability for retruding the buccal teeth, and is one of the most common methods in the author's practice.

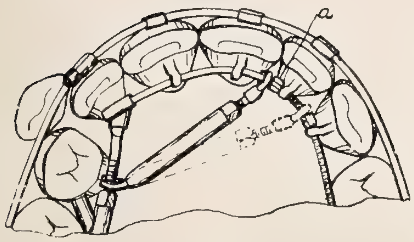
The possibility of applying the reaction force upon the molar and at any moment transferring it to the bicuspid, with attachments that permit free inclination movement, is of the greatest advantage.

The mesial end of the **lingual push bar,** Nos. 16 or 18, is received into a **flattened-tube attachment** on the right lateral **band 24,** which carries an extension to engage with the central to distribute the protruding force. The left lingual **distributing bar,** No. 18, is threaded at its extreme mesial end to screw into a **threaded-tube attachment** on the left central **band 14.** This is done to preserve the rigidity of the bar which would be softened if soldered to the band. Should it be found desirable that this bar exert a push or pull force upon any tooth or teeth to which it may be attached, it can be threaded at the distal end for nuts working against the lingual tube on molar **band 81.**

The lingual **open-tube attachment** on left cuspid **band 31** is to prevent the bar from sliding on its lingual face.

The **bar-rest jack** No. 16 can be located at any point best adapted to exert the proper lateral force. As its general location will be near to the incisal alveolar ridge, a **straight jack** will not usually interfere with the functions of the tongue after the first few days. Should it be found to do so, the **drop jack** shown in **Ap. 17,** p. 206, or the **arc jack** will be indicated.

Fig. 4.



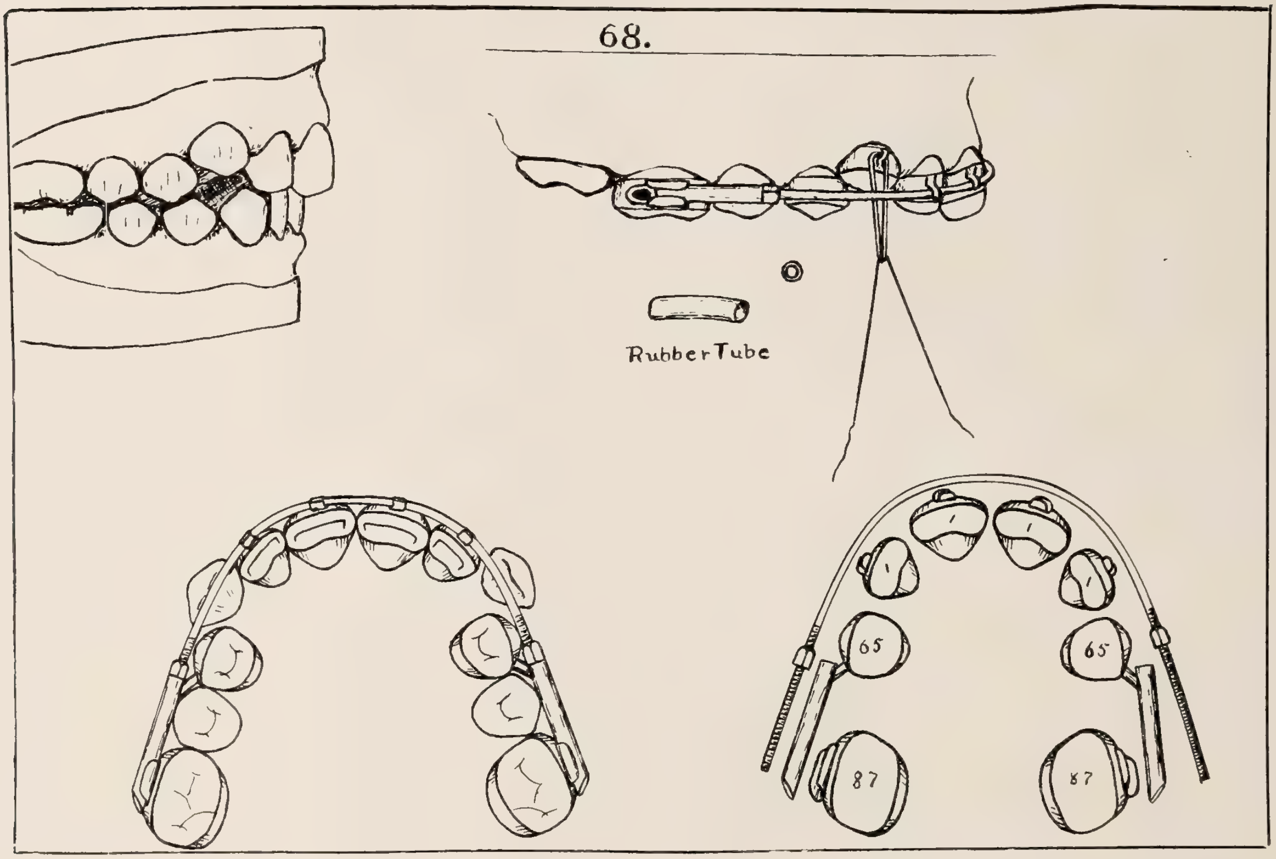
An effective variation in the above apparatus is shown in Fig. 4, which is particularly applicable when nearly all of the expanding movement from the **jack** should be brought to bear upon the right bicuspid area, by distributing the reacting force of the **jack** to a larger number of teeth through the medium of the **lingual distributing bow**. This bow, No. 18 extra hard, is attached to the right lateral by soft-soldering it into the **tube attachment, (B. 18)**.

It will be seen that the force of the **jack** upon the **bow** will aid the direction of the required movement by its tendency to carry the incisors forward and over to the left. As the bicuspids are forced to the right, in connection with this movement, the straight **lingual push bar** should be bent with the bending pliers, in proportion to the demands of their changing relations to the lateral and to permit the latter to move to the left if required. If it is desired to place the **jack** upon the **distributing bow** at a point to exert a more direct force upon the incisors, a **locating lug** or **nut** should be attached to prevent the **jack** from slipping.

CHAPTER XXVI

TYPE B. CLASS I

BILATERAL MALERUPTION OF CUSPIDS CORRECTED WITH A NORMAL OCCLUSION



APPARATUS 68

Bilateral Irregularities of this class are subject to the same rules in diagnosis and prognosis as those which govern the Unilateral characters. The correction of these cases usually requires less skill because the applied forces being reciprocally bilateral, balance each other and thus aid in preserving the symmetry of the arch.

When the dental arch is not contracted laterally and the cuspid spaces are only partially closed, **Ap. 68** will usually be found sufficiently effective for the entire correction. An arch push bow, Nos. 18 or 19, attached to the incisors as shown, reacts upon the buccal teeth through the medium of the same character of reciprocating anchorage attachments that were described in **Ap. 66,** which are constructed with a view of inducing a distal movement of the back teeth.

In the diagnosis of all characters of irregularity, and especially those of this class, the occlusion of the teeth in relation to the facial outlines, is of the greatest importance.

In a large proportion of cases of this character the buccal teeth have moved slightly forward of their normal occlusion, which may be corrected by the reaction of the bow alone, but it will be seen that this force is only that which reacts from moving the four incisors forward and when distributed to all of the buccal teeth of both sides, one cannot expect more than a slight proportional distal movement of these teeth from that source. Therefore the intermaxillary force, which may be properly termed **the great adjuster of occlusion,** will be indicated in a large proportion of cases. This is readily attached to the upper by clasping to the arch bow the intermaxillary hook tubes from which the elastics extend to the disto-buccal aspect of the lower molar anchorages.

At this juncture there should arise the important question, as to the degree of movement — if any — which the lower teeth should undergo for the greatest perfection to the facial outlines, so that in the construction of the appliances, the forces of reaction may be nullified, or on the other hand utilized to the fullest extent. This special feature of the work is fully described in Chapter VIII, **Intermaxillary and Occipital Force.**

Apparatus 69

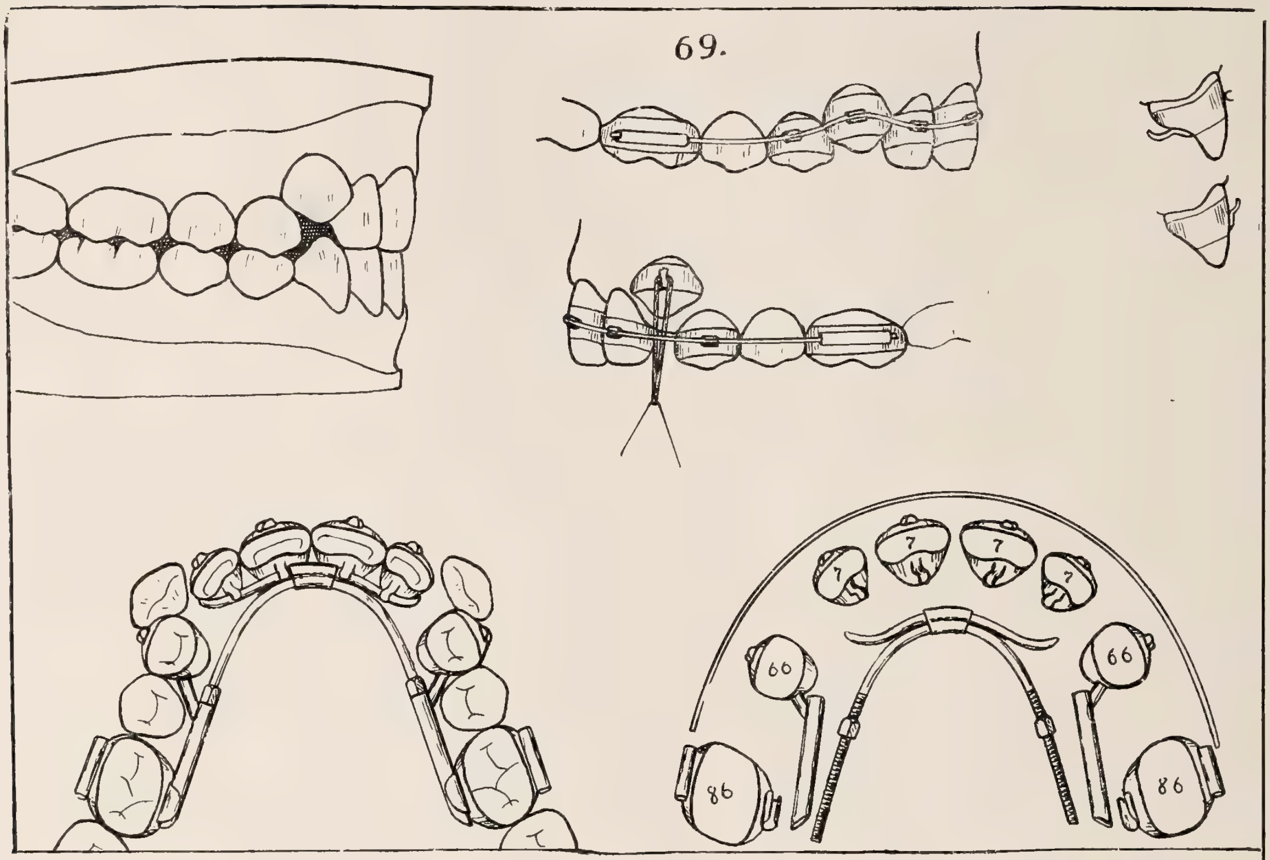
When the prominence of the cuspids will not permit placing a heavy arch bow, **Ap. 69** will be indicated. The lingual push bow here shown with buccal band attachments is one of the most practical and effective combinations in the author's practice. It is similar in its action to that of **Ap. 68,** but is far more applicable for extensive movements. The construction of the bow is fully described on p. 27.

In connection with this, the author usually employs, at the beginning of the operation, a light alignment bow Nos. 22 or 23, principally for its resilient action as shown in the buccal views of the apparatus.

There is no use in attempting to force a cuspid or other teeth into alignment until there is sufficient room for them to move in. In nearly all instances where the cuspids are in the position shown, they will usually move into place without artificial aid as rapidly as the space will permit.

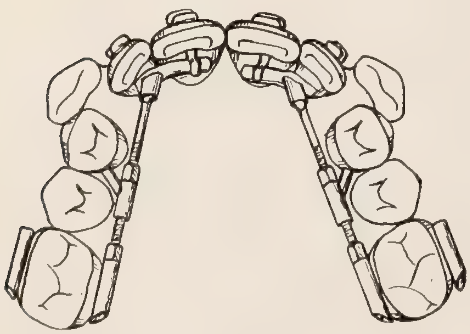
On the left is seen the common occlusion of the buccal teeth in this type, which will usually demand the application of the intermaxillary force at the first moment that it can be properly applied. Usually this is delayed until it is possible to attach the regular arch bow Nos. 20 or 19, with nuts at the mesial ends of both molar tubes.

In assembling this apparatus the yoke of the lingual bow is bent to rest properly against the front teeth, engaging with hook attachments on the incisor bands (**B. 7**). If the arch is of normal width the distal ends of the bow should lie evenly in the anchorage tubes without pressure; but if the molar area of the arch is lat-



erally contracted or expanded the bow should be bent to exert a corrective force. The molar bands may be placed first, then one of the bicuspid bands with the bow in its tube. In placing the other bicuspid band, lift the free end of the bow and slip the tube over the end and then with a hinge movement carry the band on to the tooth. Another way is to place the bicuspid bands with the bow in the tube attachments together. This may be done before or after placing the molar bands, as the bicuspid tubes can be easily sprung into the molar tube attachments. The incisor bands should be placed last, the lingual hooks having been bent properly in the preliminary assembling so as to go easily to place and subsequently clasp the bow. The alignment arch bow may be placed later, unless demanded for the correction of the incisors, and even then it may be impossible to place it at first on account of the position of the cuspids.

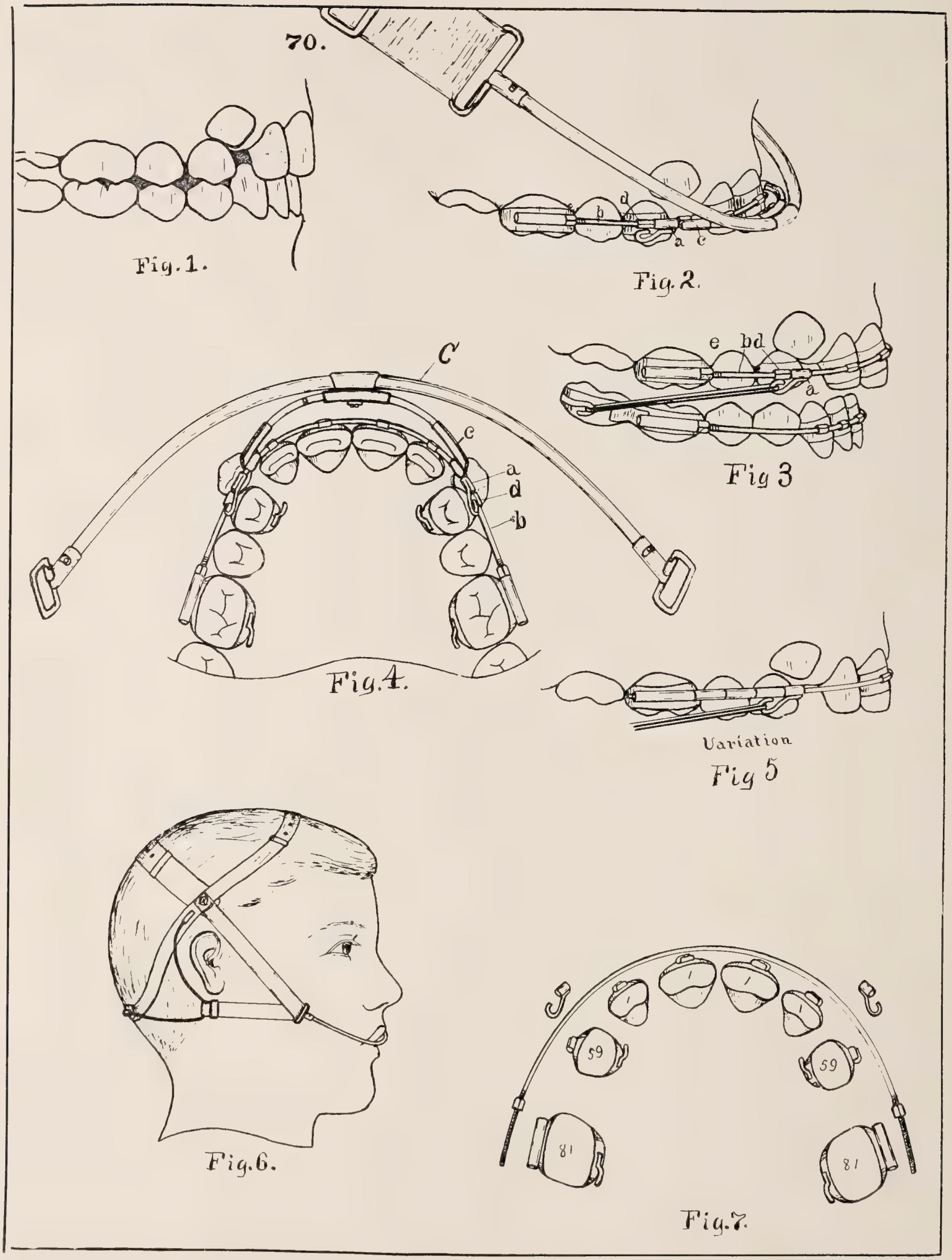
Fig. 5.



A very practical variation of this apparatus is shown in Fig. 5, which will be found effective in many cases where the malalignment of the incisors will not permit an even application of the yoke and especially where there is demanded quite a difference in the amount of force on each side.

The lingual bars (No. 18) engage directly with the laterals through the medium of elliptical tube attachments (**See B. 24**) which support an extension plate to engage with the central (**B. 7**). The bars pass through the bicuspids' tubes (**B. 67**) and into the molar tubes (**B. 84**) and are threaded for mesial nuts as shown. By this combination it will be seen that the force of reaction may be first directed upon the molars, and at any time transferred to the bicuspids with the insurance of the greatest possible utility of the force toward a distal movement of the buccal teeth. It is needless to say that the bow in **Ap. 69** could be attached to the buccal teeth in the same way. In assembling this apparatus, the lateral and bicuspid bands with the push bar should be placed together. In placing the molar band, slip the lingual tube over the distal end of the bar and then with a hinge movement carry the band to place. Finally place the central incisor bands.

In nearly all cases of this type the buccal teeth will be found in slight mesial malocclusion with the lowers, and occasionally to a greater extent than that illustrated by the drawing in **Ap. 69**. Provision should therefore be made for the application of the **intermaxillary force,** which, acting directly upon the molar teeth through the medium of the **sliding tubes** upon the arch bow, will aid the lingual bow in a general retrusion of the buccal teeth. This is fully described in connection with **Ap. 70**.


70.
Fig. 1.
d
b
a c
Fig. 2.
e bd
a
Fig 3
C
c
a
d
b
Fig. 4.
Variation
Fig 5
Fig. 6.
59
59
81
81
Fig. 7.

Apparatus 70

Application of the Occipital and Intermaxillary Forces.—There is no class with which the **intermaxillary** and **occipital force** is more applicable than that belonging to Class I, and particularly to those characters which demand a considerable distal movement of the upper buccal teeth to correct the occlusion.

Fig. 1 (**Ap. 70**) shows a common malocclusion of the teeth. If the lower teeth are in normal dento-facial pose, it indicates that the movement for the correction of the malocclusion should be accomplished by a distal movement of the upper buccal teeth, though it may be found necessary to move the incisors forward to make room for the cuspids. It also goes without saying that the incisors, both upper and lower, will commonly be found in malpositions of some form not shown by the drawings which are designed to illustrate the applicability of forces.

Occasionally the roots of the incisors are retruded, due to a lack of normal development of the incisive process, with the production of a depression of the upper dento-facial zone. If the incisal edges of the teeth, in these cases close properly in front of the lowers, the teeth will usually assume a labial inclination, which should be corrected by a protruding movement of the roots, as Nature will rarely correct decided malposition of this character even though the balance of the operation be perfectly performed. If the buccal teeth are in normal occlusion, or nearly so, and the spaces for the malposed cuspids are nearly closed, the incisors will be found occluding upon their edges or back of the lowers. This will place the irregularity in Class IV, Type B, where the proper treatment is described. See Fig. 38, p. 340.

Figs. 2, 3, 4, and 5 show methods of applying the **intermaxillary** and **occipital forces.** See "Occipital Force," p. 95. The intermaxillary tube hooks "a" sliding upon the dental arch bow "b" engage with the bicuspid attachments "d," thus communicating the retruding force from the buccal occipital bow "c," and the intermaxillary elastics, directly to the bicuspids and through them by contact pressure to the back teeth. The force exerted upon the open-tube attachments is prevented from rotating the bicuspids by wire ligatures attached to the lingual hooks. Provision is also made for protruding the incisors at the same time, with nuts at the mesial end of the molar tubes; the reaction of this force proportionately aiding in the required distal movement of the buccal teeth.

It will be seen that this arrangement comprises an important and effective combination of forces — occipital, intermaxillary, and dental anchorage — united in their action towards the distal movement of any or all of the upper buccal teeth.

Fig. 3 shows the complete intermaxillary apparatus. The figure represents a case in which it is not desirable to move the lower teeth. The intermaxillary force is therefore applied to a two or three band stationary lower anchorage, and communicated through the medium of a lower arch bow (No. 19) to all of the labial teeth, presenting a resistance of firm stability against inclination movement.

If the dento-facial relations show that the lower teeth are in a decided retruded position, demanding that the entire movement for the correction of occlusion should be made by a general protruding movement of the lower teeth, the mechanical conditions of the apparatus should be reversed; i. e., the stationary anchorage should be attached to the upper buccal teeth and the lower appliance so constructed as to produce the greatest mesial inclination movement with the least amount of force, as described in Class III, under Figs. 21 and 22. Under these circumstances the **occipital force** should not be used. The protrusion of the upper incisors to make room for the cuspids, and place all the labial teeth in the proper dento-facial position, should now be accomplished from the stationary anchorages.

If a reciprocal disto-mesial movement of both the upper and lower is demanded, it will indicate the applicability of the lower apparatus shown in Class III and the upper shown in Figs. 3 or 5. In the latter, the **intermaxillary** and **occipital forces** are first communicated through the medium of **sliding tubes** directly to the molars and afterwards to bicuspids. After the full eruption of the second molars, if a considerable distal movement is demanded, it may be found advisable to apply the force first to the second molars. When the second molars are moved back to normal occlusion they are retained with nuts placed at the mesial ends of the tubes, then bands with open-tube attachments are placed on the first molars and the sliding tubes are adjusted to communicate the retruding force as before, etc.

With the apparatus on the teeth, shown in Fig. 3, it may be found desirable to change the application of the **intermaxillary force** from the bicuspids, directly to the molars. This can be easily accomplished without removing any of the appliances by the employment of the **span intermaxillary hooks,** shown in Fig. 23, p. 315, the tubes of which may be opened and clasped to the bow on each side of the bicuspid attachment, thus causing the force to span it, and be communicated to more distally located attachments through the medium of intermaxillary sliding tubes of proper length clasped to the bow. It will be seen with this arrangement that the distal movement of the sliding tubes is stopped by the nuts "c," and through them the retruding force is brought to bear directly upon the bow. Therefore the nuts should be turned back firmly against the molar tubes with a protruding force upon the incisors in order to utilize the distal force of the **elastics** upon the molars. In other words if the nuts are screwed forward free from the molar tubes, or the molars move back free from the nuts, the only force exerted by the elastics will be in a retrusion of the front teeth. A judicious adjustment of the nuts will enable one to utilize the several forces according to the demands of the case.

If desired, the **occipital** and **intermaxillary forces** can be applied to the most distal molar upon one side of the mouth, and through the medium of sliding tubes to the cuspid, bicuspids or molars, upon the other, with equal facility. And, for that matter, both forces may be made to act upon any one or more teeth on one side of the mouth alone, by a special balancing of the occipital bow rest.

By the combination in its various details, it will be seen that any or all of the

buccal teeth can be made to receive the direct application of the **occipital** and **intermaxillary** retruding **forces,** which must appeal to all dentists who appreciate the importance of correcting occlusion for retention on the principle of extension for prevention in the operative field. Warning is here given as elsewhere that no extensive distal movement of the buccal teeth should be attempted that is destined to place them far back of their natural or inherited positions in the jaw.

Variation of Type B. Class I

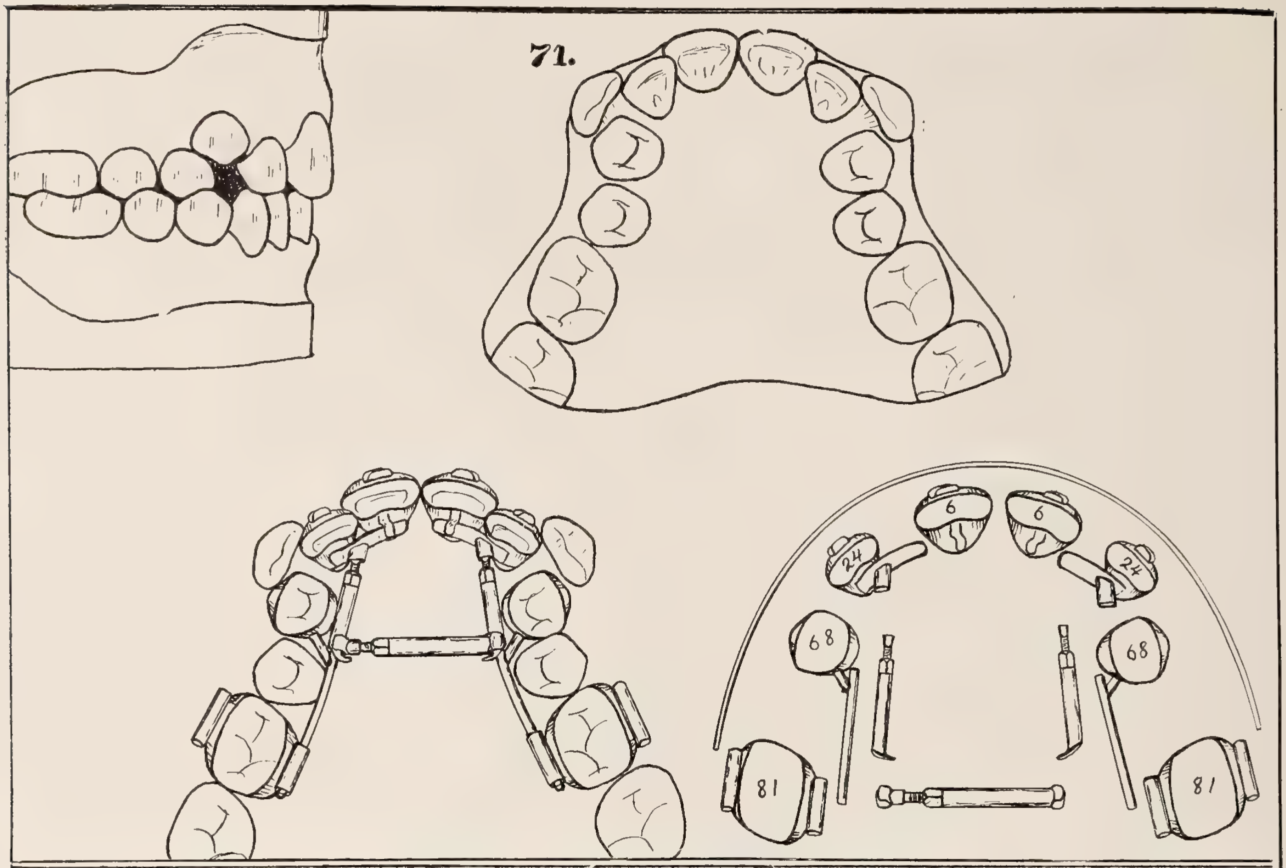
Maleruption of the Cuspids with Contracted Arches.—One of the common forms of irregularities of this class is that which is characterized by a decided crowded malalignment of the upper cuspids, the buccal and incisal zones being contracted and the dome of the arch high and narrow.

The cause of this condition may usually be traced to early diseases of the naso-maxillary sinuses, adenoid vegetations, enlarged tonsils, mouth breathing, etc., resulting in a lack of normal development of the superior maxillary bones. In some instances, the effect of this condition upon the facial outlines is quite marked, the upper dento-facial area being more or less retruded with deepened naso-labial lines and narrow seating of the nostrils. In the more advanced years of adolescence, the lower dental arch and mandible, though perhaps in normal relations, will appear to be quite prognathic, a condition that would be enhanced if an open bite malocclusion occurred from mouth breathing, as in the case illustrated with Fig. 43, p. 345.

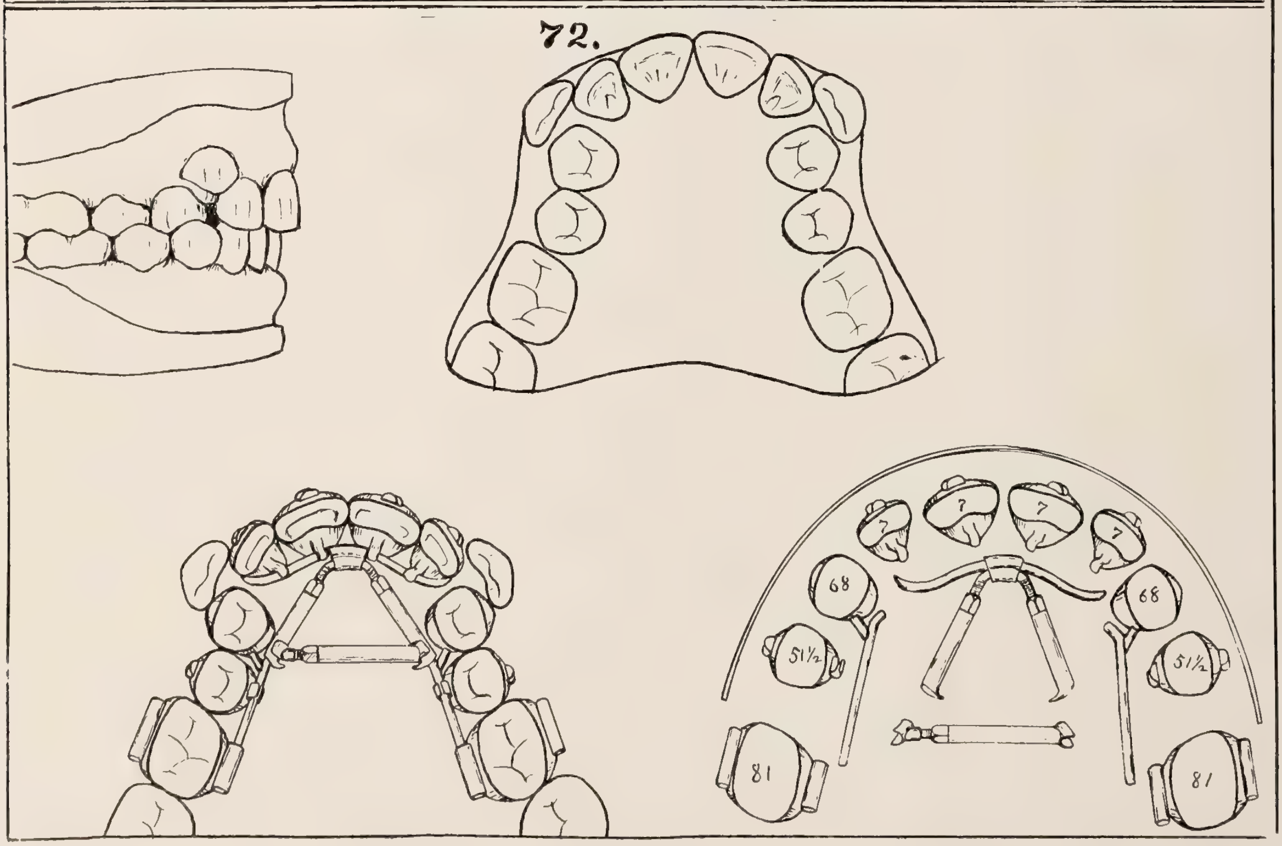
It is hoped that all who contemplate the regulation of this particular character of irregularity, will give careful consideration to all the conditions and relations; the relation of the dentures to each other and to the facial outlines; the influence upon the arches and the features by natural growth development; and the effect of placing all the teeth in the arch by artificial force. The need of expanding the apical as well as the occlusal zone is not uncommon, in which case the application of apparatus described in Class IV will be indicated.

The contraction of the upper arch will occasionally produce a contraction of the lower arch, forcing the labial teeth into malalignment, demanding a general expansion and alignment of the teeth of both arches. This character is practically shown in Figs. 30 and 31, p. 155.

71.



72.



Apparatus 71

The drawings with **Ap. 71** show the common buccal and palatal aspects of this character of irregularity, where the maleruption of the cuspids is due more to the general contraction of the arch than to a mesial movement of the buccal teeth. It will be seen that this apparatus permits a lateral expansion of the bicuspid area independent of the protruding movement of the incisors. This and **Ap. 72** have been successfully employed by the author for many years with the greatest satisfaction.

The **lingual T-bar attachment** upon the bicuspids (B. 68) differs from the **T-tube attachment** (B. 60, **Ap. 69**) which is for carrying **rigid push bars** to the front teeth, while this device is for the attachment of short **push jacks,** the different parts being well shown in the disassembled apparatus. This combination permits a lateral hinge movement of the appliance at the bicuspid area for the free action of the **expanding jack,** without exerting any lateral force upon the incisors, as would occur with the other combination, if not properly controlled and which frequently is demanded.

The position of the **expanding jack** can be changed to any point desired, though if it cross the mouth far back of the labial alveolar ridge, the **drop** or **arc jack** should be preferred. The **alignment bow** need not be attached until demanded later in the operation.

In assembling the apparatus place the bicuspid bands first and then the molar bands. In placing the latter carry the band back and slip the lingual tube over the bicuspid bar, and with a hinge movement force it on the molar. It may be found more convenient to place these two bands together. Next, the lateral bands are placed with the jacks in their attachment. In placing, slip the distal end of the jack tube on the mesial end of the bicuspid bar, then carry the band to place. The central bands are placed last.

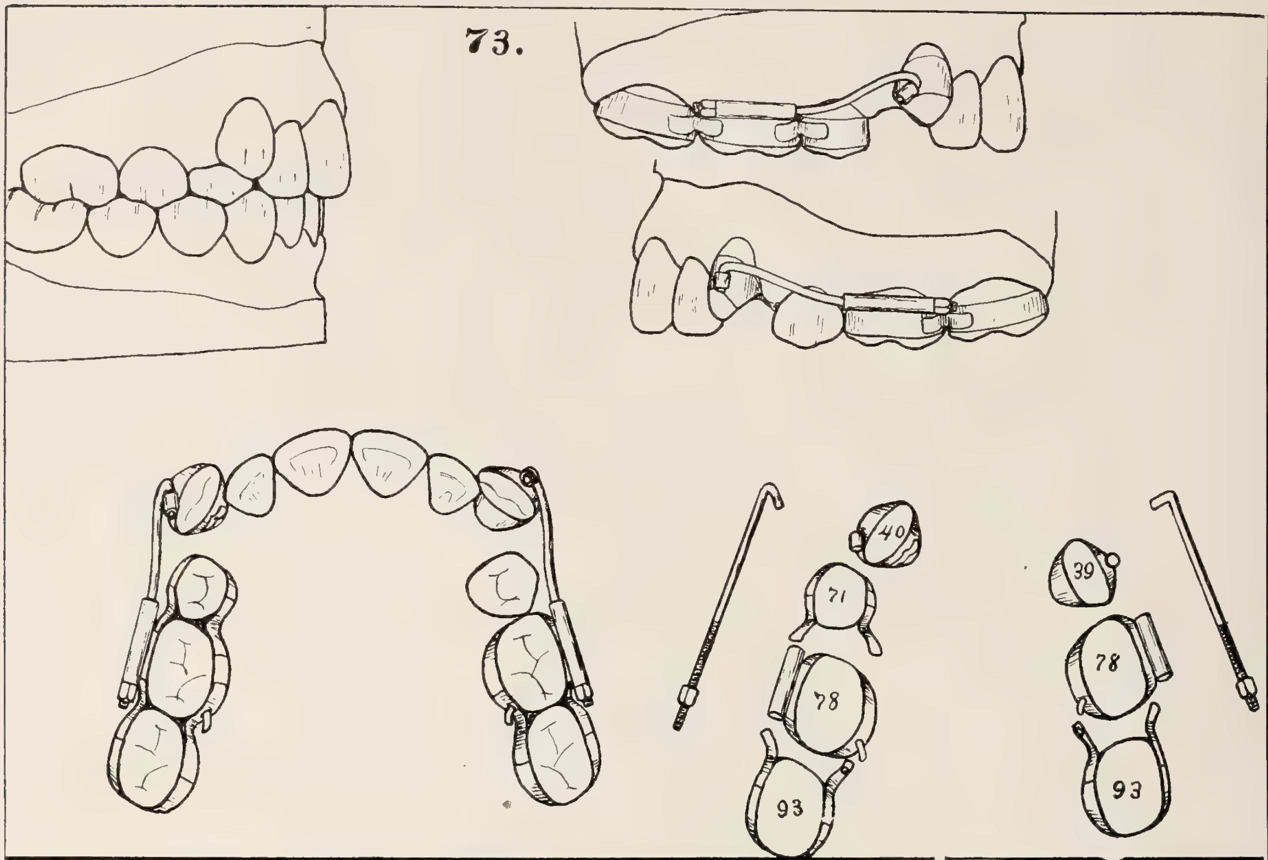
Apparatus 72

When the incisors are in relative alignment and require to be moved in phalanx with an equal distribution of force, **Ap. 72** will be found especially applicable.

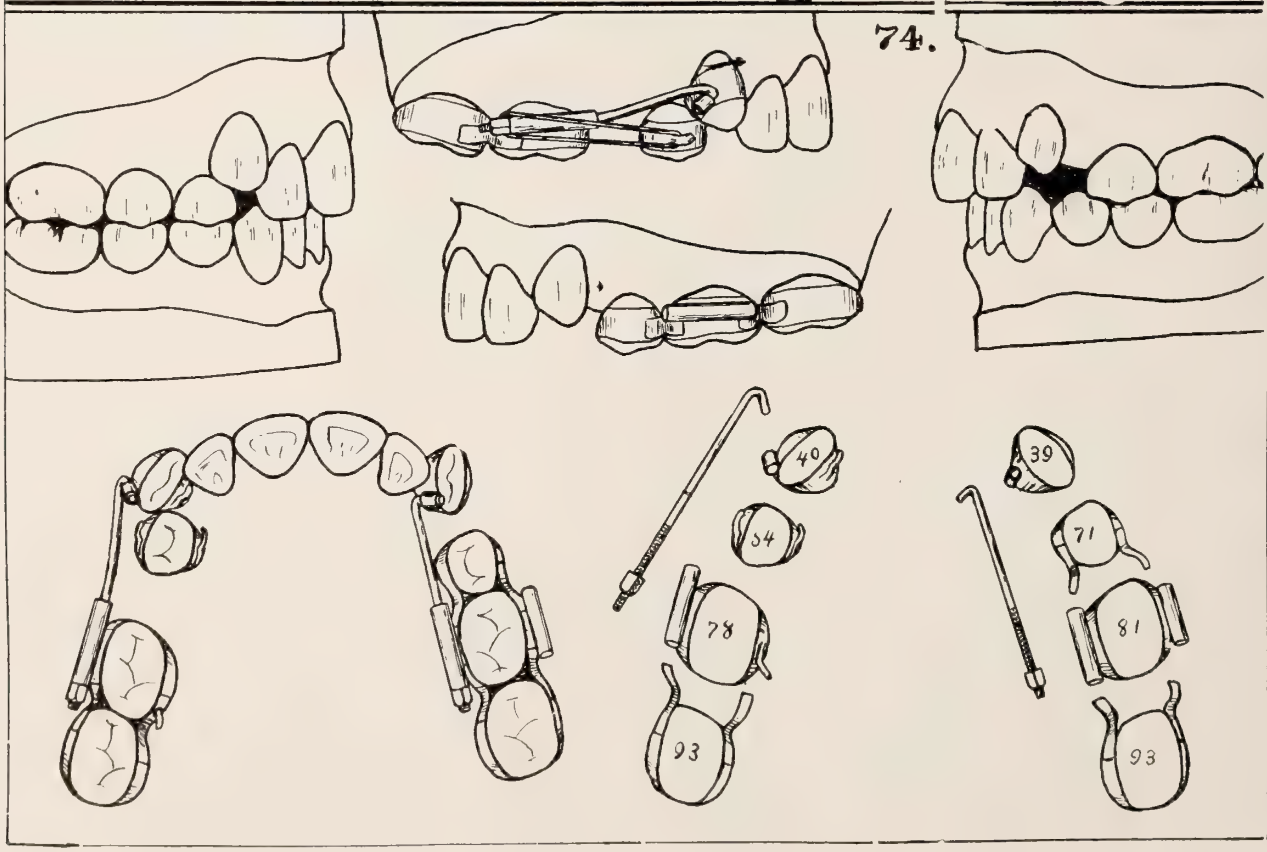
The **lingual protruding yoke** and **jacks** are well shown in the disassembled apparatus.

One of the advantages of this combination is: the reaction of the protruding force is partly exerted towards the lateral expansion of the arch so that in slight lateral contractions the laterally **expanding jack** is not needed; and in all instances this laterally applied force of the **incisor jacks** permits the removal of the expanding jack, later in the operation, the remaining appliance acting as a perfect retainer to the generally expanded arch. The assembling of this apparatus is similar to **Ap. 71,** except with a slight variation in placing the bow.

73.



74.



CHAPTER XXVII

Type C. Class I

BILATERAL MALERUPTION OF CUSPIDS, CORRECTED AFTER EXTRACTION

In irregularities of **Class I**, whenever the upper buccal teeth in relation to the lower are fully the width of a bicuspid in front of a normal occlusion, with the lower teeth in normal dento-facial relation, the case demands the extraction of the first bicuspids, especially after the eruption of the second molars. This character of irregularity is not so very uncommon, and as stated elsewhere its principal cause may be traced to an inherited mesial malposition of the upper buccal teeth, which doubtless would have culminated in a common **upper protrusion** had it not been that the early loss of the deciduous cuspids permitted the labial muscles to retrude the incisors, closing the cuspid spaces before these teeth had time to properly erupt. These conditions may also be caused by the premature loss of the temporary teeth, permitting the bicuspids and molars to drift forward and finally jump a cusp, so as to completely close the space required for the permanent cuspids. Sometimes this movement will be fully the width of a bicuspid and with no apparent reciprocal movement of the incisors — commonly the cuspid space is partially closed by the retrusion of the incisors — a movement that may be permitted by the lower teeth being crowded into a smaller arch and malposed.

If correction is attempted without extraction in this condition, as would be proper in nearly all other cases where this characteristic malposition of the cuspids occurs, the upper back teeth would require to be retruded to a typically normal occlusion; otherwise there would be a proportional protrusion of the upper teeth when the cuspids were corrected. After the eruption of the second molars an attempt to retrude the buccal teeth to the desired degree would be a very questionable undertaking, especially if it was demanded that the entire movement should be confined to the uppers, as it certainly would if the lower teeth and jaw were in normal dento-facial relations.

Apparatus 73

The technic treatment of these cases differs so decidedly from other characters of this class they almost deserve to be placed in a class by themselves.

After the extraction of the first bicuspids, the operation consists in establishing a stationary anchorage on the remaining buccal teeth, of sufficient stability to retrude the cuspids to the position of the first bicuspids. A forward movement of the anchorages may be prevented if desired with the **intermaxillary force**. In

this retrusion of the cuspids the force should be applied in keeping with the demands of movement. For instance, the right cuspid, well shown in the buccal view of the apparatus, not being malturned, the attachment of the retruding bar, Nos. 18 or 19, should be as near as possible at a point upon the cuspid that will not cause it to rotate in the process of its inclination movement. This, if exactly placed, would be on the distal or mesial surface, but as the attachment at these points would obstruct the tooth from properly moving to place, a point is chosen as near as possible to the disto-occlusal angle; then the **attachment tube** is soldered parallel-wise to the line of force so as to produce a rigid bearing opposed to rotation. This movement is further prevented by soldering to the lingual surface of the band (**B. 40**) a **hook attachment** for a **rubber band** to a lingual hook upon the anchorage.

On the left cuspid, requiring labio-distal rotation, a **hinge attachment** is placed at the greatest distance from the central axis.

Apparatus 74

When the left cuspid is malturned labio-distally, the **traction bar** with rotating attachment is placed on the lingual aspect.

The apparatus shows the common method of constructing the appliance where the second bicuspid has been extracted. The small **elastic rings** attached to the **hooks** upon the bicuspid band 54 will usually keep its movement slightly in advance of the cuspid. The drawing shows the buccal tube tipped up too much. It should lie more parallel and a resilient bar Nos. 19 or 20 should be sprung into the cuspid attachment, the force of which will extrude the cuspid as it is pulled back to place.

In a large proportion of cases the occlusion of the buccal teeth will not be the same on both sides of the mouth, requiring a variety of lateral, disto-mesial, and rotating movements with the auxiliary appliances and methods described in complex irregularities of this work.

When the natural position of the upper buccal teeth is in mesial malocclusion fully one-half the width of a bicuspid or more, after the full eruption of the second molars, as shown by the right buccal view of the irregularity with **Ap. 74,** it indicates a demand for the extraction of the second bicuspids, unless this mesial malrelation of the upper is partly due to a retruded position of the lower, in which case no teeth should be extracted — correction being accomplished with a reciprocal movement of the upper and lower teeth. In other words, if the above malrelation on both sides of the mouth is not due to the drifting forward of the upper buccal teeth, from local causes, and the lower teeth are in normal dento-facial relations, the extraction of the second bicuspids is indicated, because it is rarely if ever advisable to attempt the retrusion of buccal teeth one-half the width of a cusp, especially if in *natural* position in the jaw.

If this malrelation is only upon one side, and upon the other, as in the left

buccal view, the teeth are in mesial malinterdigitation, correction by extraction is surely indicated; therefore in this case the right second bicuspid and the left first bicuspid should be extracted. The reason why the second bicuspid instead of the first should be extracted, with an occlusion similar to that upon the right side, is because the entire space between the second bicuspid and the lateral is not needed for the cuspid, and the molar teeth require to be moved mesially half the width of a cusp to perfect their masticating occlusion, which with a distal movement of the first bicuspid, the same distance, to perfect its occlusion with the two lower bicuspids, the cuspid can then be made to take its normal position. An interdigitating occlusion can always be attained with the intermaxillary force.

The contemplation of extracting teeth for the correction of irregularities in this and other classes is a phase of the operation that should be seriously and intelligently considered in all its bearing upon the final result before it is too late.

It is a rare case, though it sometimes occurs, in which a single tooth can be extracted from the right or left side with ultimate advantage in the correction of any irregularity. In unilateral maleruption of cuspids, where it is most frequently and wrongfully practiced, it will usually be found that the incisor teeth have already drifted laterally towards the side of the malerupted cuspid, and this movement could only be increased by the extraction of a bicuspid upon that side alone. More often the case demands a symmetrical expansion as in Type A of this class.

CLASS II

PROTRUSION OF THE UPPER TEETH

Table of Types

Type A. protrusion of the crowns of the upper labial teeth

Type B. protrusion of the crowns of the upper denture

Type C. protrusion of the crowns and roots of the upper denture

Type D. protrusion of the crowns and retrusion of the roots of the upper labial teeth

Type E. protrusion of the roots with lingually inclined crowns of the upper labial teeth

---

CHAPTER XXVIII

INTRODUCTION TO CLASS II. CAUSES AND DIAGNOSIS

In upper protrusions, the upper buccal teeth are nearly always in mesial malocclusion with the lowers, and commonly through the forces of mastication the cusps are in malinterdigitation, or fully the width of a cusp in front of a normal occlusion.

While it is true with this character of malocclusion, that the lower teeth are frequently in a more or less retruded position, the present class will be confined to the description and treatment of the several types of upper protrusions with the lower normal, determined solely by the positions of the upper and lower dento-facial areas in relation to the principal features of the physiognomy.

The author is fully aware of the close relationship which this class bears to Class III, which deals with the same character of malocclusion, but which is always complicated with lower retrusions. As the two classes, however, represent the extremes of mesio-distal malocclusion, producing distinctively different facial outlines in character and treatment, they can hardly be considered as belonging to the same class, notwithstanding the almost indistinguishable blending of intermediate stages. It will be found that certain complex variations from the typical, which may belong to either class, are fully described in the class where they are most commonly found in practice.

While a protrusion of the upper teeth is the principal dento-facial malposition of Classes II and III, and while there is quite a similarity in the appearance of the articulated dental casts of the different types, it nevertheless is true that they comprise a variety of irregularities that stamp themselves upon the facial outlines with distinct characteristics, which demand special movements for their correction if one hopes to attain to the highest accomplishment of the art.

Causes

The **Causes** of nearly all dento-facial irregularities are frequently quite obscure, and while many may be traced to the direct inheritance of a family type, and others to the apparent union of inharmonious types, still, in a large proportion of cases, no authentic data of prenatal causes can be obtained that would give rise to the particular irregularity in question, though it be commonly of a type which no local cause could have produced.

Upper protrusions are not infrequently produced wholly from local causes, certain forms of which are described under Type A. Again, the premature loss of the upper deciduous teeth, resulting in mesial malinterdigitation of the cusps of the upper buccal teeth, which so often is the cause of irregularities of Class I, will occasionally terminate in an upper protrusion, and particularly when improper attempts have been made to correct them without extraction. The same is true of cases mentioned under Type C, Class I, which are characterized by labial maleruption of the cuspids which otherwise would have resulted in the common form of inherited upper protrusions.

Diagnosis

In **Diagnosis** it should not be forgotten that with upper protrusions the chin will appear to be far more retruded than it actually is in relation to the unchangeable features of the physiognomy, because of the tendency to compare it with the immediate relations of the upper.

If the upper buccal teeth are in mesial malinterdigitation, as shown in Fig. 10 and by the drawing on the left of **Ap. 75,** and the lower teeth and lip are in esthetic relations to the point of the chin — in other words, are not retruded in their dento-facial relations — the character of the irregularity will be purely that of an upper protrusion in all cases except those somewhat rare bodily retrusions of the entire lower jaw, described under Type C, Class III. And even when the lower jaw is actually retruded in its dento-facial relations, if the lower teeth and lip are not retruded in their relations to the chin, the act of forcing the lower teeth forward by interstitial movement in the alveolar process to aid in the production of normal occlusion, cannot help but make the chin appear more retruded, tending towards, if not producing, the effect of a receding chin, which is always to be avoided if possible.

The next thing of importance in diagnosis to note is: (1) whether the crowns alone of the upper labial teeth are protruded — indicated by a labial inclination — or (2) if the apical zone and alveolar process is also protruded — indicated by a normal inclination or upright position of the teeth, with a protrusion of the upper dento-facial area. The treatment of these two conditions differ decidedly from each other, and were placed in separate classes in the author's original classification.

CHAPTER XXIX

Type A. Class II

PROTRUSION OF UPPER LABIAL TEETH WITH BUCCAL OCCLUSION NORMAL

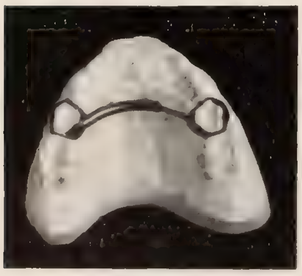
A somewhat rare form of upper protrusion is that which is characterized by a normal or nearly normal disto-mesial relation of the molars. In these cases the arches are commonly narrow, "V" or saddle-shape; and the labial teeth, which are more or less protruded, are frequently quite labially inclined.

Fig. 6

If the condition has arisen from thumb-sucking, in excessive cases the incisor crowns and adjoining alveolar ridge will be tipped forward and up by the pressure of the ball of the thumb resting well within the arch; the force being sufficient to frequently drag the cuspids and first bicuspids forward to a display of wide interproximate spaces. At the same time the arch may be narrowed by the sucking force drawing in on the buccinator muscles. Occasionally the thumb will rest in such a manner upon the lower incisors as to tip them back and thus enhance the effect of the upper protrusion. See Fig. 6.

The habit of thumb-sucking, which commences in infancy and frequently continues to, and into the early periods of secondary dentition, may be readily stopped at any time, by fitting to the upper first deciduous molars the appliance shown in Fig. 7, which consists of a **tube** and **smooth bar,** straight or curved, soldered to the respective bands, and whose easy gliding movement permits natural growth expansion. The appliance produces no material disturbance except that it prevents the thumb from taking its accustomed position.

Fig. 7.



If the irregularity be purely that of Type A, it should be corrected with a proper lateral expansion of the arch and retrusion of the labial teeth to their normal dento-facial relations.

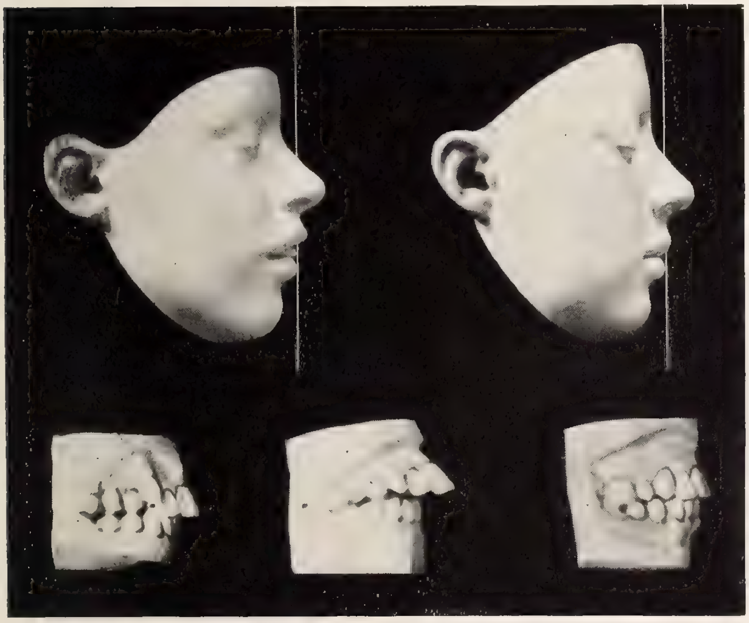
Appropriate apparatus for expanding the arch will be found in Group IV. This should be supplemented with a No. 19 retruding arch bow, with proper attachments for retruding the teeth with the **occipital** and **intermaxillary forces,** as rapidly as the widening arch will permit; the molar anchorage being used only to take up the slack.

CHAPTER XXX

Type B. Class II

PROTRUSION OF THE CROWNS OF THE UPPER DENTURE

Fig. 8.



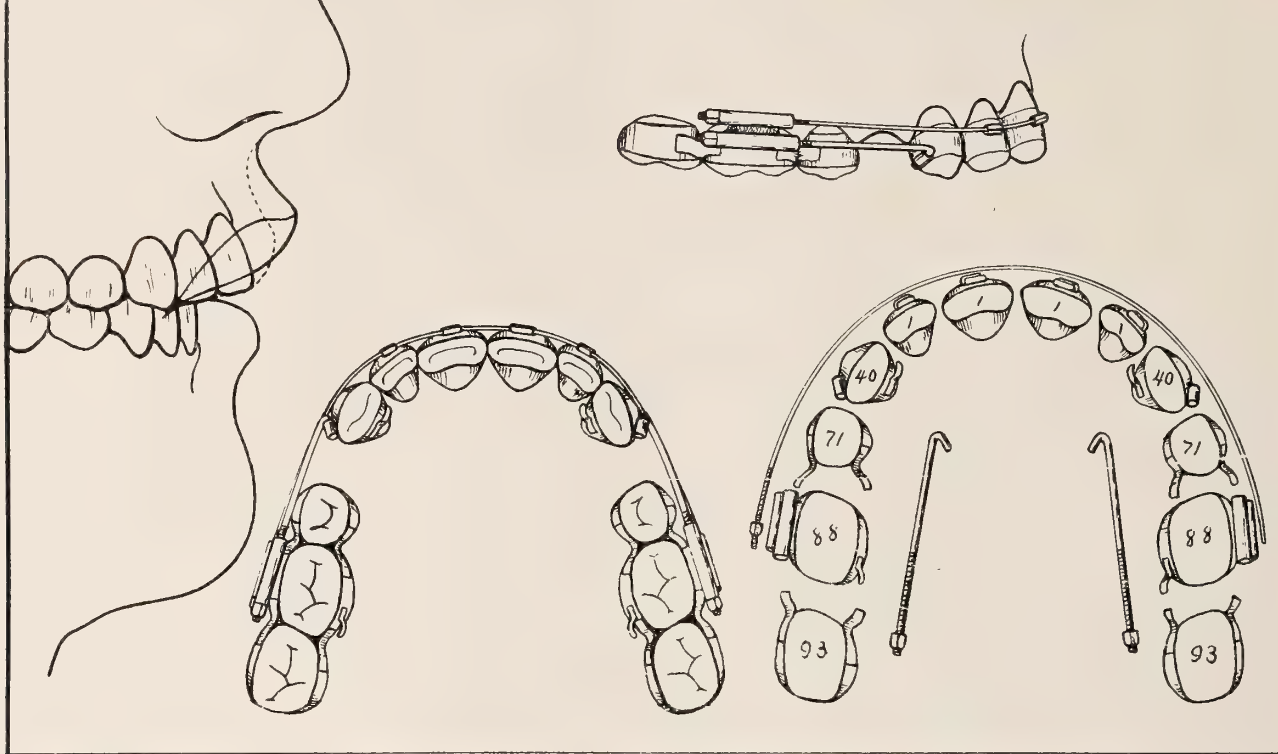
A common form of upper protrusion is that which is characterized by a protrusion of the crowns of the labial teeth, with the apical zone normal or nearly so, and with the occlusion of the upper buccal teeth in mesial malinterdigitation, demanding the extraction of the first bicuspids. This is well illustrated in the intermediate stage of Fig. 8, after an attempt had been made to correct the irregularity without extraction, which resulted in a decided protrusion of the crowns, as shown by the profile cast on the left.

Fig. 38, p. 164, illustrates two typical cases of this type. By an examination of the casts of cases of this type at the beginning of the operation, it will be seen, First: that the upper buccal teeth are in decided mesial malocclusion, and that the lower lips in relation to the chins are not retruded abnormally at the labiomental curves, which excludes them from Class III, and which means that all of the antero-posterior movements for the correction of occlusion and facial outlines must be performed on the upper teeth. Second: it will be seen also that the upper part of the upper lip or apical zone is not abnormally protruded, which in these cases is confirmed by the labial inclination of the front teeth. This excludes them from **Type C** of this class, and indicates that the crowns of the labial teeth, and not the apical ends of the roots, are protruded.

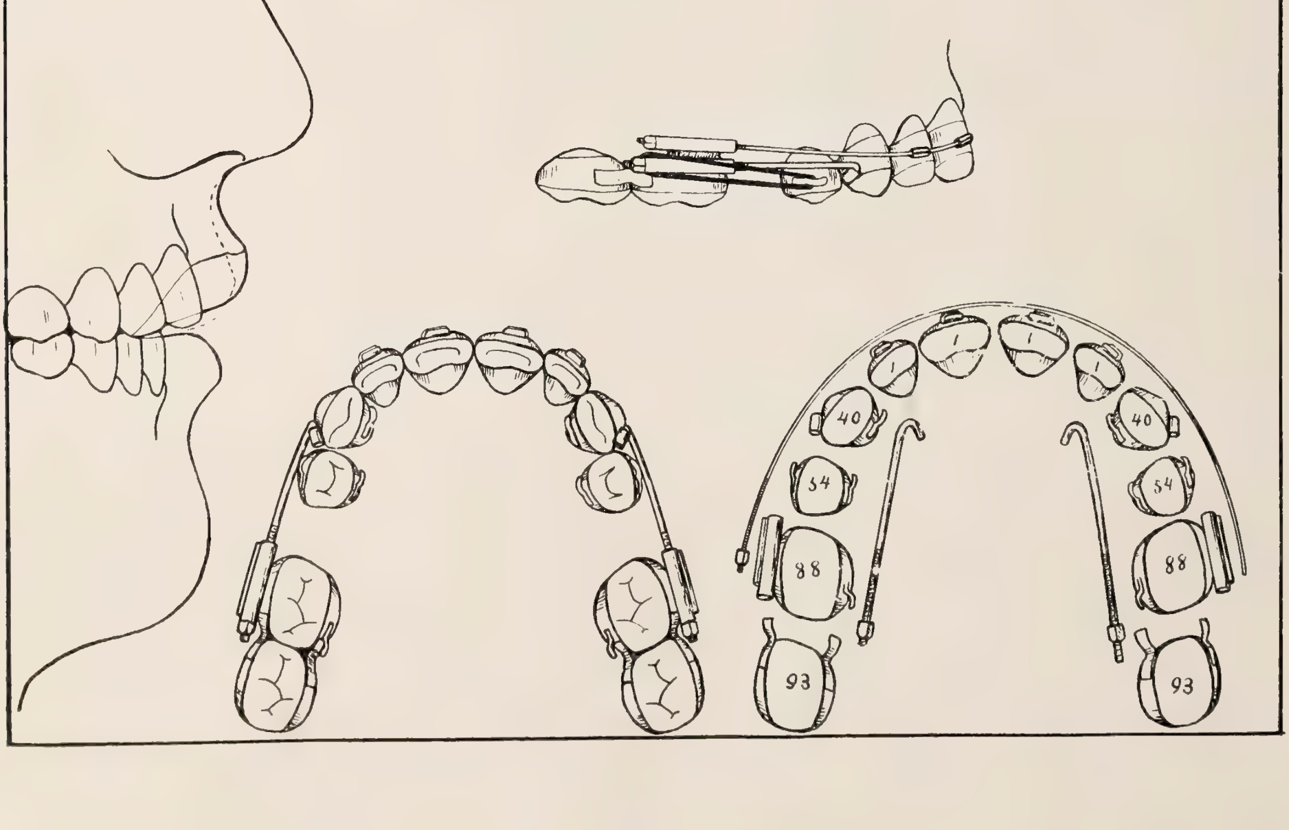
In the correction of all cases of this character the operation is reduced to the greatest possible simplicity by extracting the first bicuspids followed with a retruding inclination movement of the six labial teeth.

If the buccal teeth have completed their full interdigitating occlusion the width of a cusp in front of the normal, and the upper facial lines demand the full

75



76



extent of all the retruding movement allowed by the extraction. Care should be exercised in the construction of the anchorages and the application of forces so as to not move the back teeth forward and thus use up a part of the space.

The preservation of the original positions of all the teeth, except the six front teeth that are moved, should appeal to the common sense of all orthodontists, as opposed to a reciprocal movement of all the teeth to a normal occlusion; to say nothing about the correction of facial outlines and the greater possibilities of permanency of retention.

The permanency of any operation, however, can never be assured without an adequate retention with properly constructed fixtures. This is well illustrated in the history of the case shown in Fig. 8, which I have recently learned — years after the completion of the operation — did not remain in the perfect positions shown. This was through no fault of the method or the result, but because the patient drifted away from my care soon after the retainers were placed, and did not return as she should have done at periodic intervals, or at the first indication of failure.

Apparatus 75

In **Ap. 75** the three band anchorages carry two buccal tubes. The lower for No. 19 traction bars for retruding the cuspids, is soldered at the gingival border of the bands, and the upper for a No. 22 arch traction bow for retruding the incisors, is soldered to the lower tube with an intervening lift to free it from the gum and separate the two nuts, so that they can be grasped by the wrench in turning. The root-wise position of the tubes aids in the stability of the anchorage.

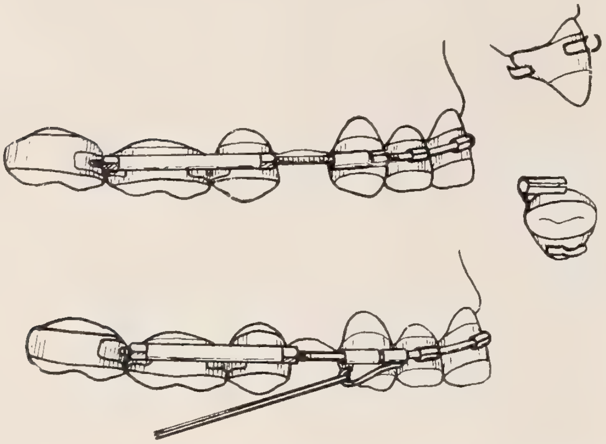
The same rules relative to the position of attachments, etc., for retruding the cuspids should be observed as shown in **Aps. 73 and 74**. An important feature of the apparatus that should never be omitted is the lingual hook on **B. 40 and B. 88** for the attachment of elastics to prevent the rotation of the cuspids and aid in their retrusion. The open-tube attachments on the incisor **bands 1** are of very thin material (20–32), which when properly locked around the small wire bow (No. 22) with all sharp edges removed and finished, present no unpleasant and irritating prominences to the lips. The incisor bands should usually be made of B. & W. gold, with the labial portions considerably narrowed; which with the small size of the bow aids in the inconspicuousness of the apparatus.

When any doubt arises in regard to the immovability of the anchorages, the occipital and intermaxillary forces should be employed. In nearly all cases of this type the occipital force with post-rest bow A is indicated.

A variation of the above apparatus, which has come into frequent employment in the author's practice through a desire to utilize the intermaxillary and occipital forces for the retrusion of the labial teeth in this class of irregularities, is that which attaches the cuspids directly to the arch retruding bow, through the medium of the cuspid tube attachment (**B. 34½**) instead of the extra traction bars with B. 40.

By this combination, shown in Fig. 9, the cuspids may be retruded with the dental arch bow, by turning the hexagon nut at the cuspid, without exerting the slightest retruding force upon the incisors. In this way the force required to retrude the cuspids may be alternated with that required for the incisors and thus relieve the anchorages from the combined forces.

Fig. 9.



In the lower drawing in Fig. 9 is shown how this attachment is employed for the intermaxillary force. Attention is particularly called to the peculiar construction and function of this cuspid attachment. (See B. 34½, p. 56.) It will be seen that the force is applied upon the distal aspect of the cuspid crown, in a manner to promote the freest distal inclination movement and least liability toward rotation. Rotation is further prevented by the grasp and bearing of the tube attachment to the retruding arch bow.

Apparatus 76

Moderate Protrusion of the Crowns in Type B.— When the upper buccal teeth are in moderate mesial malrelation, or not more than one-half the width of a cusp in front of a normal occlusion, and the relation of the lower lip to the chin is one that will not bear the slightest protruding movement, the extraction of the second bicuspids is indicated for patients older than 12 years. Frequently, the extraction of the first bicuspid on one side, and that of the second upon the other is demanded, because of the difference in mesio-distal occlusion of the buccal teeth.

When the malocclusion is bilateral, with a moderate upper protrusion, *be careful that it is not partially a lower retrusion, or sufficiently so as to warrant correction with the intermaxillary force without extraction.*

Apparatus 76, which is designed for a moderate upper protrusion of Type B, where the second bicuspid has been extracted, is so similar in its construction and application of force to **Aps. 74 and 75,** it will be unnecessary to further describe it here.

CHAPTER XXXI

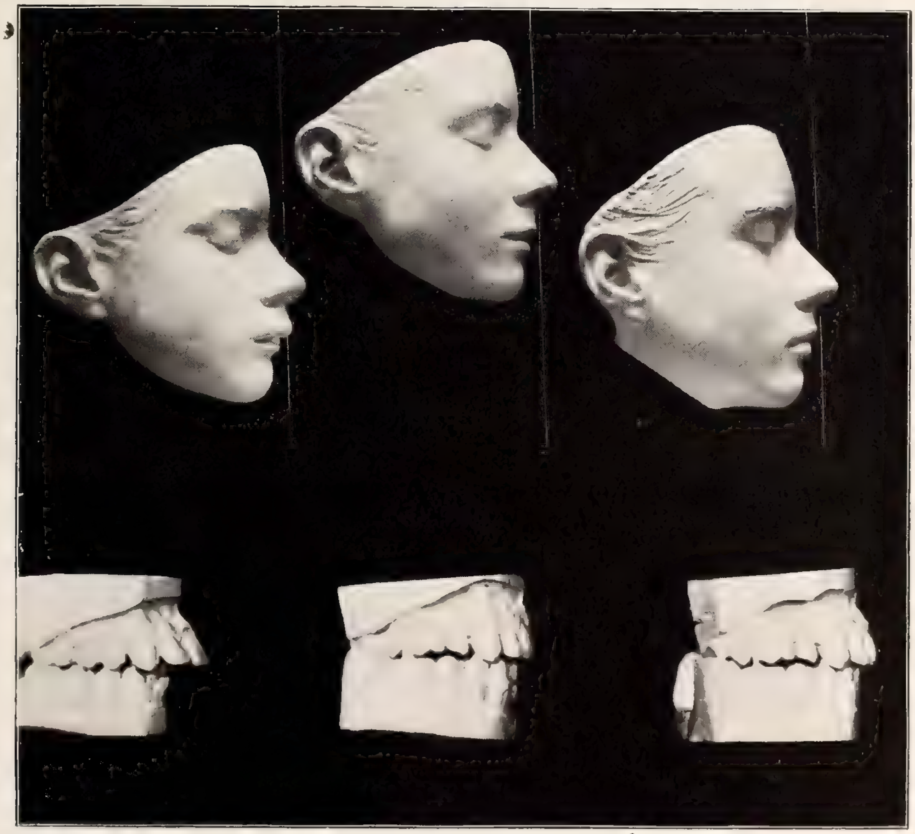
Type C. Class II

PROTRUSION OF THE CROWNS AND ROOTS OF THE UPPER TEETH

Preliminary Considerations: – In decided **upper protrusions** of an inherited type, the roots and alveolar process, as well as the crowns, may be protruded in their dento-facial relations, as pointed out in other chapters.

In diagnosis this **bodily protrusion** of the upper teeth is not always recognized nor even apparent until the crowns of the front teeth have been retruded in the ordinary way. Therefore in all cases of upper protrusion, where the teeth are not decidedly inclined labially with an apparent dento-facial retrusion of the apical zone, as in Type D, the retruding force should be applied at, or near the

Fig. 10.



gingival borders of the incisors, as in **Ap. 77**. Not that the force applied at this point will retrude the apical ends of the roots, but that it will tend to distribute the force further root-wise, and at least prevent moving them forward.

This is not so necessary for the cuspid teeth because of the greater length of their roots, which being partially imbedded in more solid bone structure, increases the improbability of moving the apical ends by any ordinary means. Again, if the direction of the retruding force and movement of the cuspids were at right angles to the arch as with the incisors, instead of along the line of the arch, or distally, the tendency towards tipping their roots in the opposite direction would be increased.

If the case is purely that of **Type C,** or one in which the labial roots as well as the crowns are protruded, it will be found, after the retrusion of the crowns — if it is not discovered before — that the upper part of the upper lip, or **upper apical zone,** is unesthetically prominent, with an unpleasant bulginess at the base of the nose, often obliterating the naso-labial lines.

Fig. 10, which is a typical case of Type C, will serve to illustrate the results of the different stages of treatment in a case of this character. On the left is shown the relative position of the upper teeth and upper lip before treatment. The central figures were made from casts at an intermediate stage of the operation after the labial teeth had been retruded with force applied at the gingival borders. At this time the prominence at the base of the nose is seen to be far more apparent than at first. This may have been partly due to the forward movement of the apical zone of the incisors, in the process of retruding the crowns, notwithstanding the fact that the apparatus which the patient wore, applied the force at the highest gingival borders.

In this connection it would be well to remember that the lingual borders of the incisor alveoli are often situated at a more rootwise position than the line of force applied to the crowns, unless it be upon rootwise extensions, as in the contour apparatus. Furthermore, that the cortical layer of the alveolar process at this point presents a strong resistance to movement, and consequently is quite a stable fulcrum when the incisors become levers of the first kind, in the application of force appliances.

On the right of Fig. 10 is seen the effect of retruding the apical zone with the **retruding contour apparatus 83.**

This final retrusion of the roots of the incisors and incisive process was quite as beneficial in beautifying the physiognomy, compared to the intermediate stage of the operation, as was this stage when compared to the original condition. It gave to the entire features a different expression, and permitted the lips to close in perfect pose; which would not have been possible otherwise. Compare this operation with the possible attempt at correction without extraction, on the basis of producing a normal occlusion, by moving the lower teeth forward one-half the width of a cusp and the upper back the same distance, with the intermaxillary force. And what would be the result? Decidedly a partial bimaxillary protrusion of the entire dento-facial area. The teeth would be in unpleasant evidence in laughing and talking, and the strained effort to close the lips would enhance

the already receding chin effect that would be produced by the abnormal protrusion of the lower teeth. This is a lesson which cannot be too often repeated in this era of delusive teaching.

In cases of this type the upper teeth are not protruded in relation to the superior maxillæ, but the entire supramaxillary process and its immediate attachments seem to be protruded in relation to other parts. The upper teeth therefore being in perfect harmony to the size of the jaw, and the lower teeth not being retruded in their dento-facial relations, if the facial protrusion is really corrected, teeth must either be extracted from the upper jaw or all of the upper teeth must be retruded about the full width of a bicuspid. This is a self-evident proposition, and as the latter method is not to be thought of, it is generally better to extract the first bicuspids in order to move as few teeth as possible; though if the first bicuspids are sound and the second much decayed, remove the latter. Again, if the bicuspids are sound or nearly so, and the first molars are of that character which indicates their early loss, remove the molars. But this should not be done after the eruption of the second molars, unless one is prepared to completely close the wide molar spaces, by a bodily movement of adjoining teeth. The method is fully explained on p. 355, Chapter XLVI.

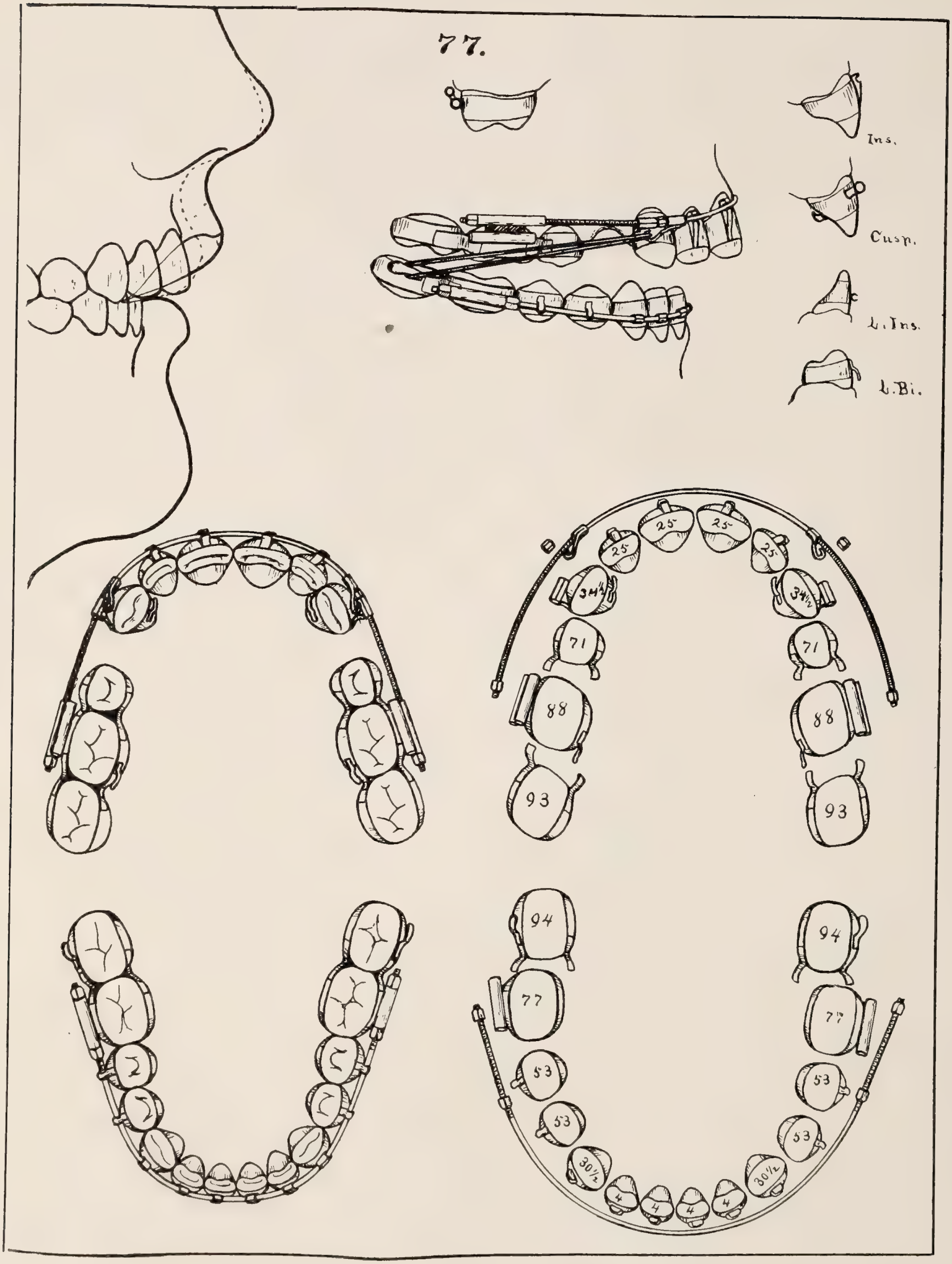
Apparatus 77

As it is not always possible to determine at the beginning of an operation, for patients of this type, how much may be accomplished by applying the force at the gingival margins of the teeth, the regular Contour Apparatus is not placed at first unless a decided protrusion of the roots is evident.

Apparatus 77 represents one of the most common and effective methods in the author's practice for retruding the labial teeth after the extraction of the first bicuspids.

Its construction admits of the application, separately or in combination, of three characters of retruding force, i. e., Stationary Dental-Anchorage, Occipital, and Intermaxillary. The arch bow, No. 19, if employed with the hexagonal nuts at the mesial ends of the cuspid open-tube attachments, as shown in the disassembled apparatus, may be made to exert all of the force from the molar anchorages upon the cuspids alone, or it can be equally distributed to all of the labial teeth according to the degree to which the cuspid nuts are turned in proportion to that of the anchorage nuts.

The force is applied to the incisors at the gingival borders by means of extensions soldered to the labial faces of the bands to lift the bow from the interproximate gingivæ. If it is desired to increase the force upon the incisors, or to relieve the anchorage force, and especially if an intruding force is demanded, the **occipital force** may be employed as an auxiliary, with the post rest bow A, as shown in **Ap. 78;** the distal nuts being turned only to take up the slack of the bow. The **intermaxillary force** with sliding hooks engaging directly with the retruding arch


77.
Ins.
Cusp.
L. Ins.
L. Bi.
25
25
25
25
25
25
34½
34½
71
71
88
88
93
93
94
94
77
77
53
53
53
53
30½
30½
4
4
4
4

bow through the medium of the nuts is invaluable as an aid in retruding the labial teeth.

Without the nuts the cuspids may be retruded with the intermaxillary force as shown, and supplemented, if desired, with the occipital force with bow-rest C as in **Ap. 70**.

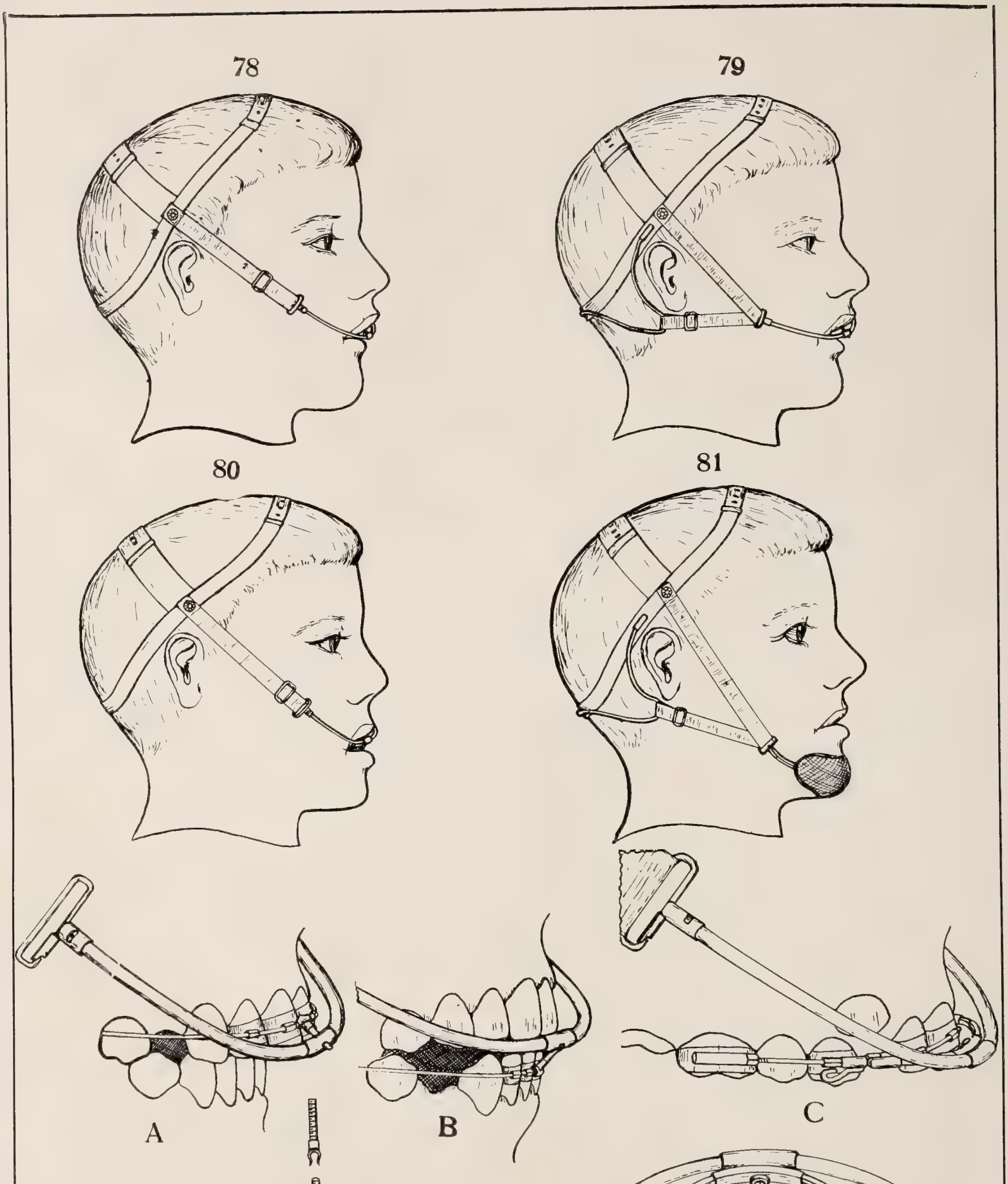
The lingual hooks upon the cuspids for rubber ligatures to the lingual molar hooks will often be found useful to control or increase the action.

As the apparatus is designed for **Type C,** in which the malocclusion is entirely due to a protrusion of the upper, it will be seen that the lower teeth are quite firmly locked together for the purpose of permitting no mesial or extruding movement. The lower molars carry the regular two-band stationary anchorages which can be extended to the bicuspids if desired. The distal intermaxillary hooks on the molar anchorages are wide, buccally convex, and attached to the disto-occlusal points. The bicuspids and labial teeth are firmly attached to the No. 19 arch bow, by means of hooks and open tube attachments, which in turn are firmly locked to the molar anchorages with mesial and distal nuts.

The intermaxillary hooks for the attachment of the elastics to the upper are soldered to short tubes, which in this case slide back along the retruding bow and engage with the attachments of the cuspids. I have used this form of hook for the intermaxillary force for the last ten years. There is no patent upon it, so that all are free to construct and use it. Its peculiar form is such that the elastics are easily adjusted and will not slip off. It is non-irritating to the tissues and aids in keeping the elastics parallel to the occlusal plane. Its position on the bow can be regulated by short tubes to communicate the force to any buccal point upon the bow.

In Fig. 23, p. 315, is shown a variation of this apparatus for employing the **span intermaxillary hooks** for exerting a direct distal force upon the back teeth. This is one of the most effective and practical devices in the author's practice for the application of the intermaxillary and occipital forces to the upper buccal teeth. By the employment of this hook the points of engagement of the forces are placed in front of the cuspids, and by spanning the cuspids are communicated through the medium of sliding tubes on the bow to any of the buccal teeth. Instead of the sliding tubes, the spanning bar may be lengthened to the desired point. It greatly increases the practical field of usefulness of Bow C (p. 296) of the **occipital force.** The **spring arcs** of this bow are adjusted with a set screw to any desired length, so that the open tubes at the ends of the arcs, while grasping the dental bow, will engage directly with the span-hooks and exert a distal force, to be communicated through this medium to the back teeth.

In all cases where a considerable distal movement of the buccal teeth is desired, and especially those of Type B, Class I, the occipital force, in the author's practice, has now become one of the most important auxiliaries.


78
79
80
81
A
B
C
A
C

Occipital Apparatus 78, 79, 80 and 81

The principles and uses of the **Occipital Apparatus** are outlined in Chapter VIII. It differs from all other apparatus that have been employed to exert occipital force in the variety of movements it is capable of producing, and in its provisions for adjustment to each individual case, so that it can be worn with perfect comfort and with no projecting portions to interfere with the pillow at night.

The **head-cap** of the apparatus, well shown in the accompanying illustration, is composed of thin metallic ribbons which are properly shaped and provided with adjustable gears for fitting it to the size of the head. It lies smoothly upon the surface; it places the force where it is least felt; and leaves the head almost entirely free. **Silk elastics** of the proper heft are used for the motive power. They are buttoned to the head-cap with glove fastener attachments, and pass through **lock swivel loops** at the ends of the **occipital bow,** to **sliding buckles** for adjusting the amount of force.

Bow "A" — shown in the lower drawings — is employed to exert a retruding and intruding force upon the upper labial teeth; bow "B," a retruding and extruding force upon the lower labial teeth; and bow "C," a distal force upon the buccal teeth.

Fig. 11.

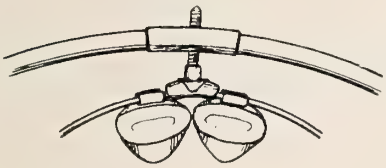


Fig. 11 shows an improved form of post-rest-attachment, which is intended to prevent the sliding movement which may cause the other device to become unseated from its attachment to the dental bow.

The use and effectiveness of the apparatus depends largely upon the manner in which the several parts are adjusted and fitted. In fitting the **head-cap** the encircling band should rest well back upon the head and pass just above the ears; the two bands being adjusted to exert an even pressure throughout. Carefully bend the occipital retruding bow to conform to the surfaces over which it rests, nearly touching but not pressing against the lips and cheeks. Its final relations to the lips are adjusted with **bow "A"** by screwing the post rest in or out; with **bow "B"** by bending the posts; and with **bow "C"** by adjusting the arc rests to properly engage with the attachments on the dental bow.

The **chin-cap** shown in **Ap. 81,** is made of fine wire gauze, soldered to a frame of proper form and provided with the swivel attachments for the elastics. When fitted to the chin it presents a ventilated cap which exerts an even and comfortable pressure.

CHAPTER XXXII

Type D. Class II

PROTRUSION OF THE CROWNS AND RETRUSION OF THE ROOTS OF THE UPPER LABIAL TEETH

From causes not always possible to discover, upper protrusions are occasionally characterized by a **retrusion** of the **apical zone.** As diseases of the nasomaxillary sinuses obstructing the growth development of the upper jaw may arise with every physical character and which commonly produce a contracted and malaligned arch, it would seem that when this influence did not commence early enough to prevent the crowns from attaining their normal alignment, the apical zone alone would remain contracted, while the general growth enlargement

Fig. 12.

of surrounding structures would force the crowns forward with an outward flare of the teeth. This movement would particularly affect the labial teeth and be emphasized in cases of inherited upper protrusions.

The labial inclination of the front teeth and retruded incisive fossæ will pro-

trude the lower part of the upper lip and retrude the upper dento-facial area, thus deepening the naso-labial depressions and often retruding the entire lower portion of the nose in relation to esthetic facial outlines. Of course there is every degree of dento-facial inharmony with the labial teeth in this same inclination, from decided protrusions of the incisal zone with the apical normal, to decided retrusions of the apical zone with incisal normal.

Fig. 12, made from a case in practice, will serve to illustrate the dento-facial irregularities of this type. It will be seen that the upper buccal teeth are in full mesial malinterdigitation. When the case presented, the first bicuspids had been extracted and the crowns of the labial teeth had moved back through the action of the lips. Before this, it was said that the teeth were much more protruded and with a more decided labial inclination, which must have enhanced the retruded effect at the upper part of the lip. This retruded effect was quite apparent as can be seen by the profile model on the left. Even the end of the nose, compared to the finished case, is seen to have been improved in its outlines in the process of protruding the roots and incisive process.

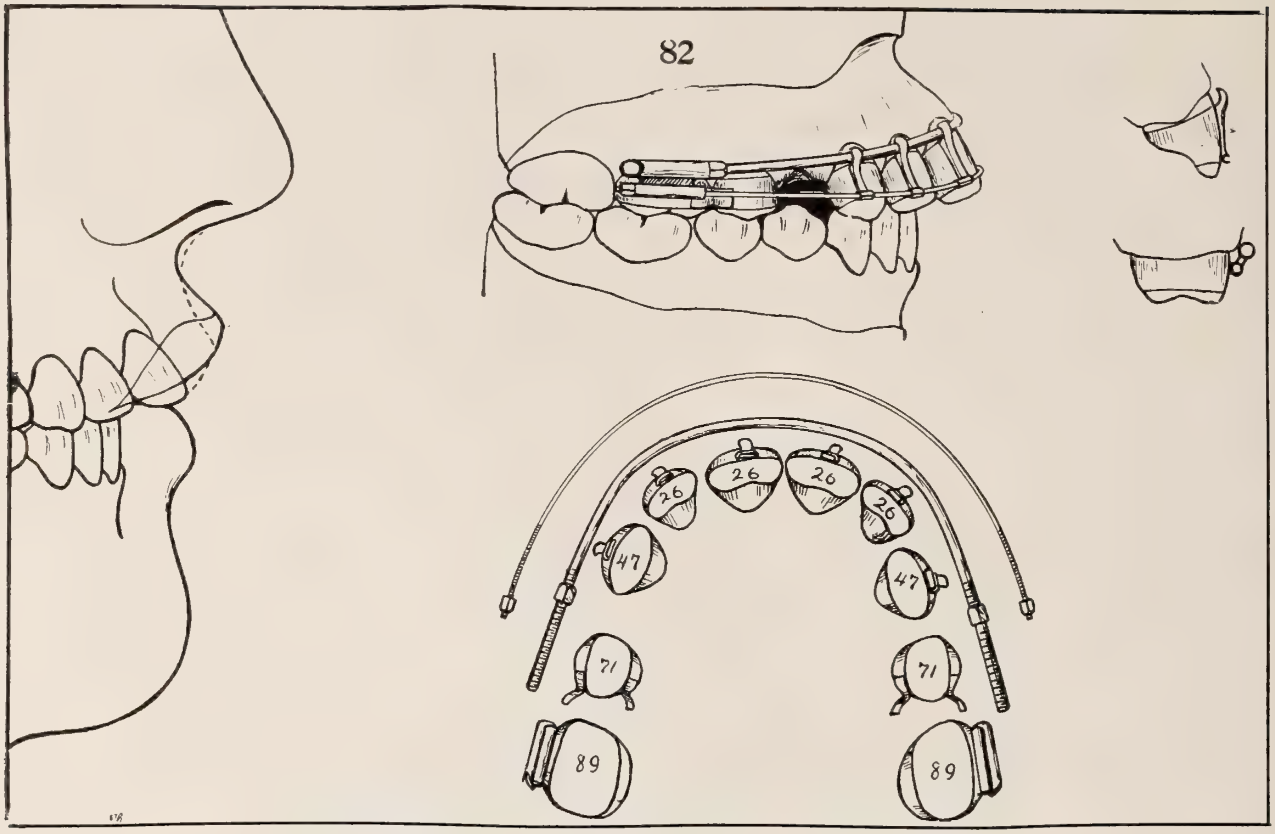
The deepening of the naso-labial lines at the points where they join the wings of the nose (which is apparently caused by a retruded position of the framework supporting the lower end of the nose, in connection with a protrusion of the lower portion of the upper lip), produces a peculiar facial expression that at once indicates the character of the dental malposition. It is an expression, moreover, that is not uncommon in protrusions of the labial teeth which arise from thumb-sucking, or that of Type A of this class.

Apparatus 82

Apparatus 82 is especially designed for correcting crowded irregularities of Type D, when the occlusal relations demand the extraction of the first or second bicuspids, followed by a retruding movement of the crowns of the labial teeth and a protruding movement of the roots.

The mechanical principles which underlie the method of applying force for the movement of the roots of teeth are fully exlpained under "Bodily Movement," p. 79, Chapter VI. When this method was first published in 1893, the author named it the "Contour Apparatus" merely for convenience, and because it was the first method ever invented that made it really possible to practically contour the dento-facial area.

This method of applying force will never be understood or appreciated by any one who is not willing or is incapable of skillfully constructing, fitting, and placing the proper appliances for its correct application. When the preliminary work is accomplished as it should be, there is no extensive apparatus that will give so little trouble or annoyance to the patient or operator, nor one over which the operator has more perfect control of the movements of the teeth, and none that will give so much satisfaction in the final result. This applies particularly to the



protruding movement described under **Ap. 87**, where a full description will be found relative to the details of constructing and fitting the **protruding contour apparatus.**

The present apparatus differs from **Ap. 87** only in the degree of its possibilities of movement. In all cases where a maximum power is not demanded, (as in an extensive movement of the roots,) the entire apparatus should be reduced in the size and heft of its parts to meet the requirements and avoid bulkiness. It will be noticed also that the shorter length of the root-wise attachments (B. 26) causes the power to be applied at the gingival borders; though as has been stated, even when the power is applied further rootwise with the larger bow properly fitted, no irritation or inconvenience is experienced by the patient.

The reciprocal action of the two required forces will nullify each other at the anchorage in proportion to the weaker power, which is true of all reciprocal forces acting upon a given point; therefore the probable direction and magnitude of the excess, or resultant, should be noted, as to the influence it will exert upon the anchorage teeth and the need of reinforcing their stability against the mesial or distal movement that may be produced.

For instance, in the irregularity shown by the drawings, the greater power will be required for the retrusion of the crowns, consequently the excess will tend to move the anchorage teeth mesially. It will be noticed that the buccal teeth of the drawing demand this mesial movement about one-quarter the width

of a bicuspid to correct their interdigitating occlusion, therefore no more than a two-band stationary anchorage is indicated. But if the cusps of the upper buccal teeth were in full mesial interdigitation a three-band anchorage would be demanded if possible, and if not, the occipital or intermaxillary auxiliaries would be indicated to prevent a mesial movement of the anchor teeth.

In cases where the apical zone of the front teeth is but slightly retruded the force of a single retruding bow applied at the incisal zone will usually be sufficient to tip the roots forward the required distance in the retrusion of the crowns,—the gingivo-lingual borders of the alveolar process acting as a fulcrum.

In **Ap. 82** the upper or "**power bow**" Nos. 16 or 14 will act more as a fulcrum, and the lower or "**fulcrum bow**" Nos. 20 or 22 will be the moving power, though considerable force will be exerted upon the power bow as it is not an easy matter to move the roots of teeth with the short distance between the points of fulcrum and power permitted by the contouring **band 26.** If the retrusion were greater, requiring a considerable movement of the roots, **B. 27** as in **Ap. 87** would be indicated.

Fitting the Protruding Contour Apparatus

The bands should be perfectly fitted and the whole apparatus completely assembled on the teeth preparatory to the final placing. The power bow being very rigid should be perfectly bent to lie evenly in the respective attachment without the slightest spring when in position. The reader is directed to the fuller description of the construction and fitting of the more forcible Protruding Contour Apparatus 87. In the final placing, first cement the anchorages upon one side and place the end of the power bow in the buccal tube. When the cement is placed in the bands of the other anchorage, slip its tube on to the free end of the bow before carrying the anchorage to place upon the teeth. Then the labial bands are placed one at a time, the gingival hooks lapping on to the bow. The placing of the fulcrum bow needs no direction.

In the progress of the operation, if it is found that the roots are being protruded more than they should be in proportion to the retrusion of the crowns, the power bow nuts at the mesial ends of the anchorage tubes should be unscrewed, allowing the roots to move back. It will be seen with this combination that the operator has full control over the individual movements of the roots and the crowns of the incisors.

CHAPTER XXXIII

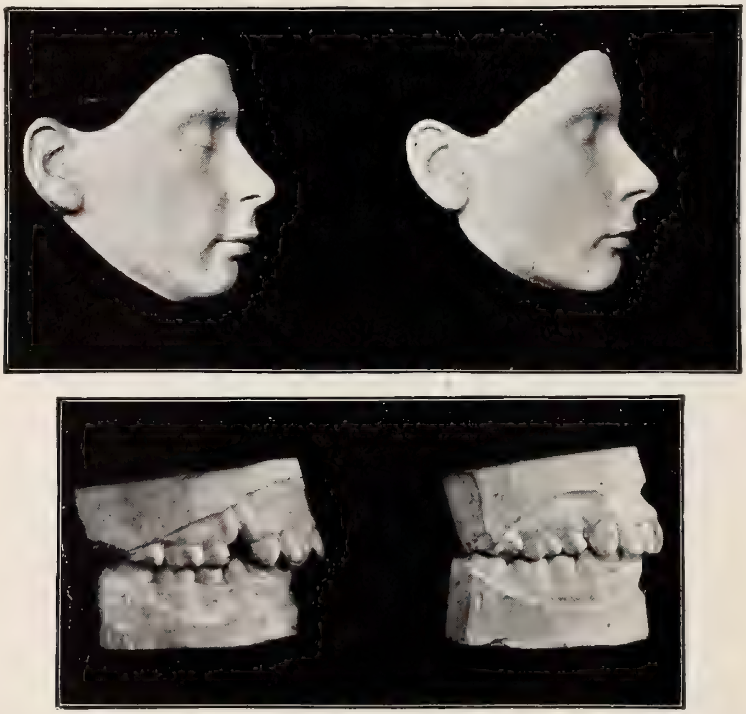
Type E. Class II

PROTRUSION OF THE ROOTS OF THE UPPER LABIAL TEETH

Irregularities of this type are far more rare than their opposites of Type D, probably because they seem to be unassociated with any condition that may have resulted from a local cause that could have acted indirectly through a retarded development of the upper jaw, which so commonly obtains with retrusions and contractions of the apical zone.

Malformations of Type E, of a pronounced form, are characterized by a decided prominence or bulginess along the upper part of the upper lip and base of the nose, completely obliterating the naso-labial lines, while the lower part of the lip is not

Fig. 13.



protruded. In all of these cases it would seem as if there was an inherited protrusion of the upper jaw of one parent, and the small teeth of the other, the muscles of the lips crowding the teeth back into contact alignment and lingual inclination. Whereas if allowed to stand in an upright position, the crowns as well as the roots would be protruding with wide spaces between,— a condition that sometimes occurs (See Cryer, Fig. 15 B, p. 121).

The lips close with difficulty and rarely with repose, while in talking or laughing they often rise to an unpleasant exposure of not only the entire crowns but the gums above, producing at times an exceedingly unpleasant expression.

Fig. 13 will serve to illustrate this type. It was made from the plaster casts of a young man who was 18 years of age at the commencement of the operation.

Fig. 14.

It will be seen that the apical zone was greatly protruded, as shown by the facial cast before treatment, while the contrusion of the centrals and cuspids forced the laterals out of line. The incisal edges of the centrals in this case, as is common with this malposition, hugged the lower incisors near to their gingival margins. As in all cases of this type the occipital force was an important auxiliary, particularly because of its intruding quality, which tended to lift the teeth and process up, so that the gingivo-lingual ridges could pass the cutting edges of the lower as they were moved back. When this case was first published (Dental Cosmos, Nov., 1905) the operation was not completed, as stated at that time and as may be seen by the facial and dental casts on the right of the figure which was employed to illustrate it. The result of the completed case may be seen by the final facial cast shown in Fig. 14.

Apparatus 83

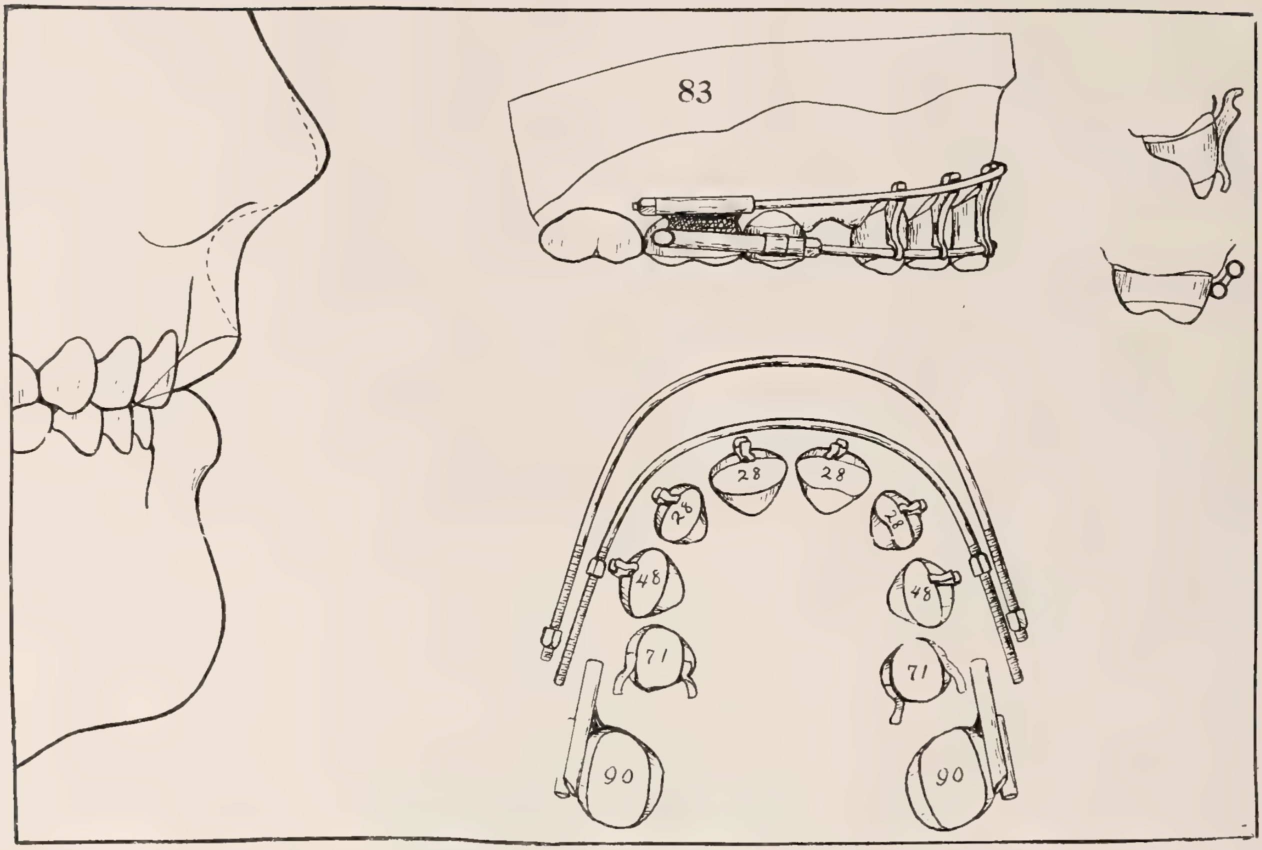
Apparatus 83 illustrates the common contour retruding apparatus, the principles of which — shown also in **Aps. 82, 84, and 87** — have been for many years an indispensable adjunct in the author's practice.

In marked cases of Type E the first bicuspids should be extracted, because every opportunity for the movement of the roots and alveolar ridge should be given.

The anchorages are constructed in stationary character, (**See B. 90**), with the buccal tubes firmly located and pointed toward the lines of force. The upper, or **power bow,** is No. 16 extra hard German silver. The lower, or **fulcrum bow,** is No. 17. The **fulcrum bow** is larger than in the apparatus for protruding the roots because it exerts a push force, while the upper or **power bow,** exerting a pull force, does not need to be as large.

The labial bands (**Bs. 28 and 48**) should be made of No. 38 banding material and extend from the gingival to the incisal borders, perfectly contoured and fitted to the teeth. The attachments should be constructed and placed to apply the retruding power above the border of the gums and the fulcrum power at the incisal zone. They should be so shaped as to withstand the force, protect the gum, and still not be bulky.

In assembling the apparatus preparatory to cementing it, the bows should be bent so that when in place they will lie evenly in their attachments without the



slightest spring of the material. When everything is fitted the whole apparatus should be assembled on the teeth without cementing. In the final placing, the labial bands and one anchorage are first cemented in place. After placing the cement in the bands of the other anchorage, the **fulcrum bow** is placed in its respective tubes and when the anchorage is forced to place, the bow is carried into its labial attachments. The **power bow** is then sprung into its tubes.

While the operation of retruding the roots of the upper incisor teeth is not uncommon in Type C of Class II, in the author's practice he has treated only four typical cases of Type E. Two of these were over 18 years of age, and the other two were over 14, whereas this particular operation should be started if possible as early as 13 years of age, because the entire retruding movement of the roots of the teeth is made by virtue of interstitial resorption that requires great force and time to accomplish. Therefore the nearer to the cartilaginous stage it can be commenced is an advantage.

Fig. 43, p. 169, illustrates a most perfect result of an operation of this character for a young lady over 20 years of age. The linguo-incisal borders of all the upper incisors rested against the labio-gingival borders of the lower incisors, the roots being decidedly protruded. This case is described at length in Chapter XIV, where will be seen a final photographic illustration of the patient taken some years after the close of the operation.

CLASS III

LOWER RETRUSIONS, WITH UPPER NORMAL AND UPPER PROTRUDED

Table of Types

Type A. RETRUSIONS OF THE LOWER TEETH WITH PRONOUNCED PROTRUSION OF THE UPPER

Type B. PRONOUNCED RETRUSIONS OF THE LOWER TEETH WITH UPPER MODERATELY PROTRUDED

Type C. RETRUSIONS OF THE LOWER JAW AND TEETH

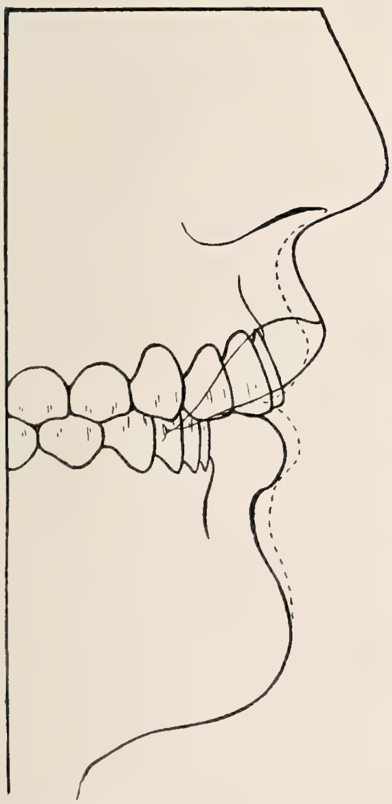
Type D. CLOSE BITE MALOCCLUSION, INCLUDING FULL BIMAXILLARY INTRUSION

CHAPTER XXXIV

GENERAL DIAGNOSIS OF CLASS III

The occlusion of the teeth in this class is quite the same as in the common upper protrusions, or **Class II**, but the facial outlines show that the malrelation is characterized, partly or wholly, by a retrusion of the lower teeth. This class therefore includes all cases in which the lower teeth are retruded in their dento-facial relations, in connection with which the upper teeth are usually more or less protruded, though they may be normal.

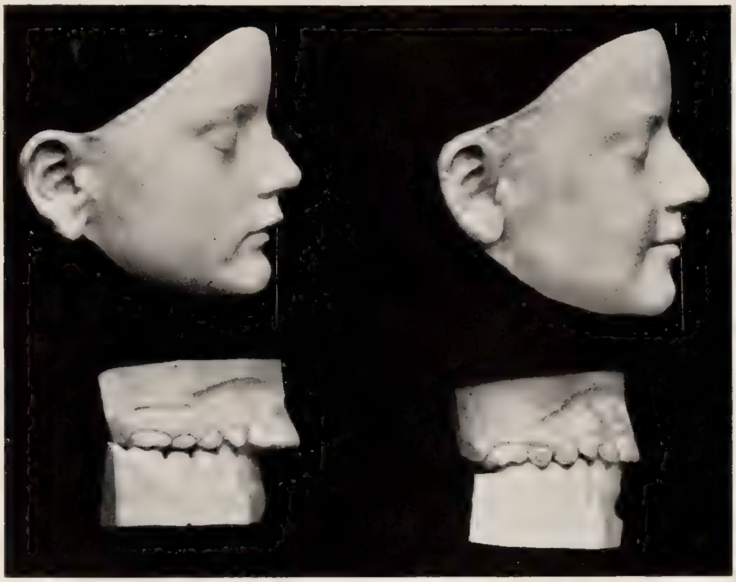
Fig. 15.



Figs. 16 and 17 are presented to illustrate the facial outlines before and after correction in marked characters of this class. It will be seen in the beginning facial casts that the mandibles — characterized by the relations of the chins — are not retruded in their dento-facial relations, but that the lower lips — characterized by the deepened labio-mental depressions — are quite decidedly retruded in relation to the chins and upper lips, and that the upper lips are but slightly protruded in their dento-facial relations. As the labial teeth and surrounding alveolar processes constitute the framework upon which the lips depend for their contour, this at once defines the irregularity in this instance as a decided retrusion of the lower denture and a slight protrusion of the upper, or **Type B** of this class; and therefore in treatment this particular malrelation of the teeth must be restored upon that basis in order to properly correct the facial outlines.

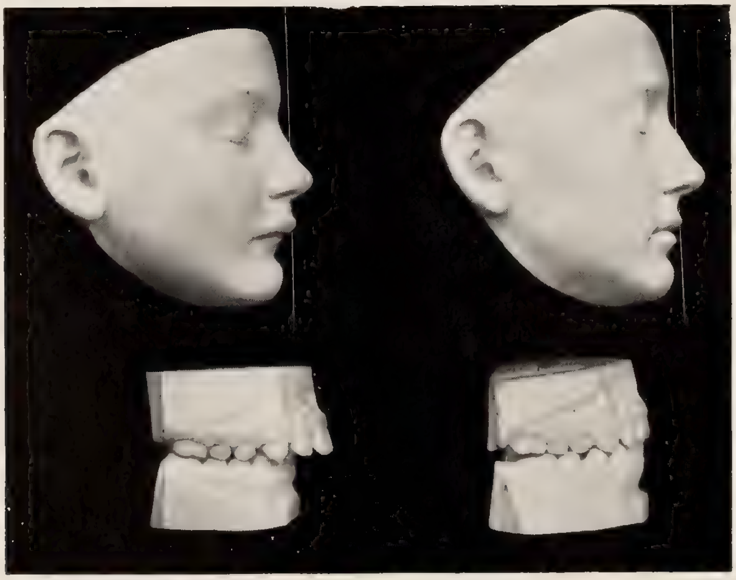
As pointed out in previous chapters, the occlusion of the buccal teeth should never be taken as a basis for determining the character of an irregularity. This is most perfectly and repeatedly exemplified in Classes II and III, where the upper buccal teeth in relation to the lower are often the width of a cusp in mesial maloc-

Fig. 16.



clusion. Occasionally there arises even a greater disto-mesial difference than the width of a cusp. With malocclusions of this character the extremes are: Protrusions of the Upper with Lower Normal; and Retrusions of the Lower with Upper Normal.

Fig. 17.

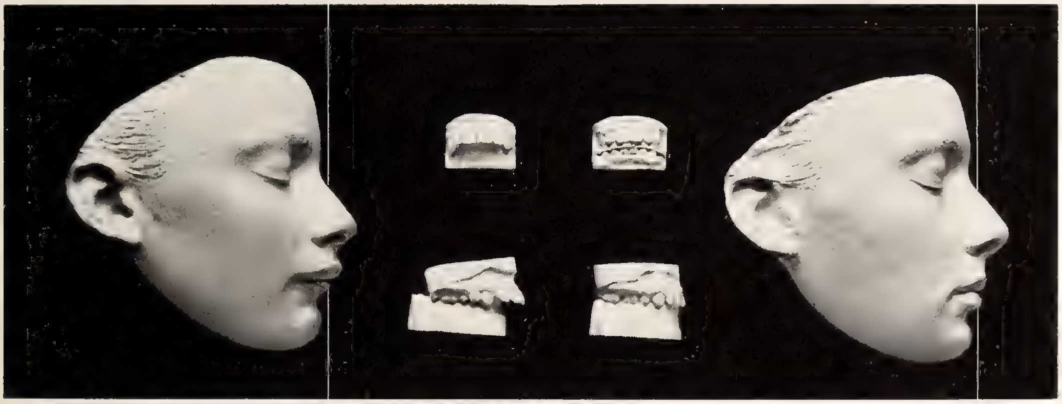


Between these extremes will be found a perfect gradation of dento-facial inharmonies containing many distinct characters which differ from each other quite as much as they differ from dento-facial inharmonies produced by other malocclusions.

If the cusps of the buccal teeth of this class are in malinterdigitation, or in other words, if the upper teeth are the width of a cusp in front of a normal occlusion, it will usually be found that the dento-facial relations of the upper and lower dentures individually are in an inverse ratio to each other in the degree of their malpositions.

One of the most common complications of an upper protrusion is that which is characterized by a partial or slight retrusion of the lower teeth (**Type A**). From the same cause, decided lower retrusions are often accompanied with slight or moderate upper protrusions (**Type B**). Between these two pronounced forms of this class, every inverse gradation will exist, the composite of which will be a protrusion of the upper accompanied with an equal retrusion of the lower.

Type A



A pronounced retrusion of the lower teeth with upper normal, which forms one of the extremes of this character of malocclusion, is quite rare; and as it is similar to Type B in appearance and demands of treatment, it will be considered under that type. It should be understood that these two types refer to retrusions of the lower teeth and not to retrusions of the mandible, which is **Type C**.

Two of the most pronounced forms of Types A and B of this class are shown in the accompanying illustrations. The illustrations of the plaster casts of these cases, which appear also in Chapter XIV, are again introduced here to call especial attention to the important difference in the facial outlines of the two types.

In that of Type A the upper lip is seen to be decidedly protruded in its dento-facial relations, while the lower lip is but slightly retruded. That of Type B shows a marked retrusion of the lower lip with only a slight protrusion of the upper. In both of these cases the upper front teeth were in decided evidence when the lips were in natural repose, which goes without saying that the occipital force with its intruding and retruding action was an important auxiliary in the correction.

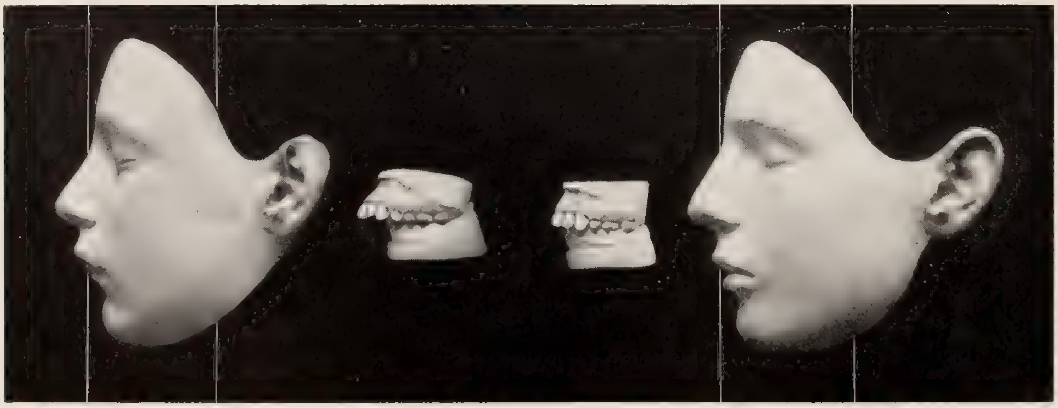
TYPE B

The photographs of these patients which appear below the casts were taken several months after the completion of the operations and are introduced in connection to show how much greater the improvement always appears in viewing the patients themselves or their photographs, instead of the cold expressionless facial casts which exactly copy the outlines.

Type C of this class, shown below, which consists of a retrusion of the mandible and lower teeth, is not so very rare; while **Type D,** or close bite malocclusions shown on the left of **Ap. 85,** is common to both Classes II and III.

In the diagnosis, a careful consideration of the facial relations of the chin, lower lip, and lower teeth is of the greatest importance in determining the special type to which the case belongs, among so many which have the same character

TYPE C



of occlusion. This is especially important in **Class III,** in which one of the types in correction demands the extraction of teeth, whereas with another type of this class such a procedure would be the height of malpractice.

It is in **Class III** particularly that the **intermaxillary force** is applicable, and especially in correcting the occlusion and facial imperfection by a reciprocal disto-mesial movement of the upper and lower teeth without extraction.

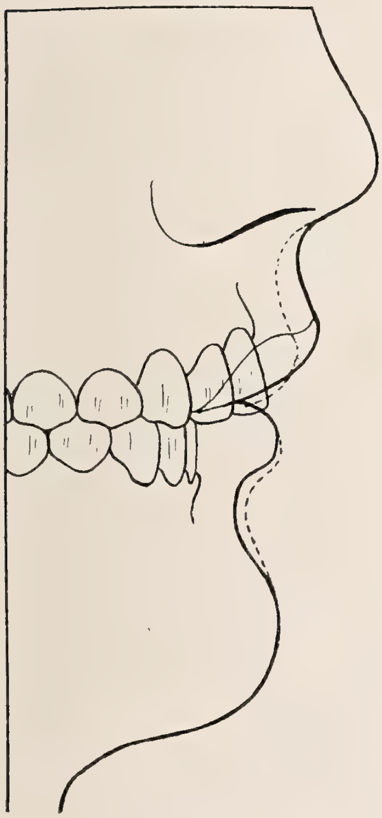
CHAPTER XXXV

TYPE A. CLASS III

RETRUSIONS OF THE LOWER WITH PRONOUNCED UPPER PROTRUSIONS

In following the rules of diagnosis and treatment in this class of disto-mesial malocclusions, if the chin is found to be in normal pose in relation to the principal features of the physiognomy, and the lower teeth are but slightly retruded with a concomitant deepening of the **labio-mental** depression, and consequently with a pronounced protrusion of the upper teeth and lip, as shown in Fig. 18, it will be usually advisable to extract the first or second upper bicuspids, with the expectation that the forces required to retrude the upper labial teeth to a position of dento-facial harmony will be made to so re-act upon the **upper buccal teeth** and all the **lower denture** as to move them slightly forward to the desired degree, and thus completely close the bicuspid spaces and preserve the original disto-mesial interdigitating occlusion of all the buccal teeth.

FIG. 18.



It will be seen that this type differs from the ordinary upper protrusion in the one particular that the lower teeth are retruded. This can only be recognized by a careful study of the facial outlines. The apparatus indicated for the upper in a purely Type A character is the same as that illustrated and described in Class II, and chosen according to the particular type of the upper protrusion; always being careful to arrange for the application of the intermaxillary and occipital forces to relieve the stress upon the upper molar anchorages. The lower apparatus for the application of the intermaxillary force has also been fully described, and should be constructed to retard or accelerate the forward movement of the denture in proportion to its degree of needs. The complete apparatus which the author has found most commonly applicable in these cases is similar to **Ap. 77,** Type C, Class II.

The reader is referred to a description of four practical cases of this type in Chapter XIV, the illustrations of which are marked Figs. 39 and 40; also to Mesio-Distal Malocclusions, Chapter XII, p. 139.

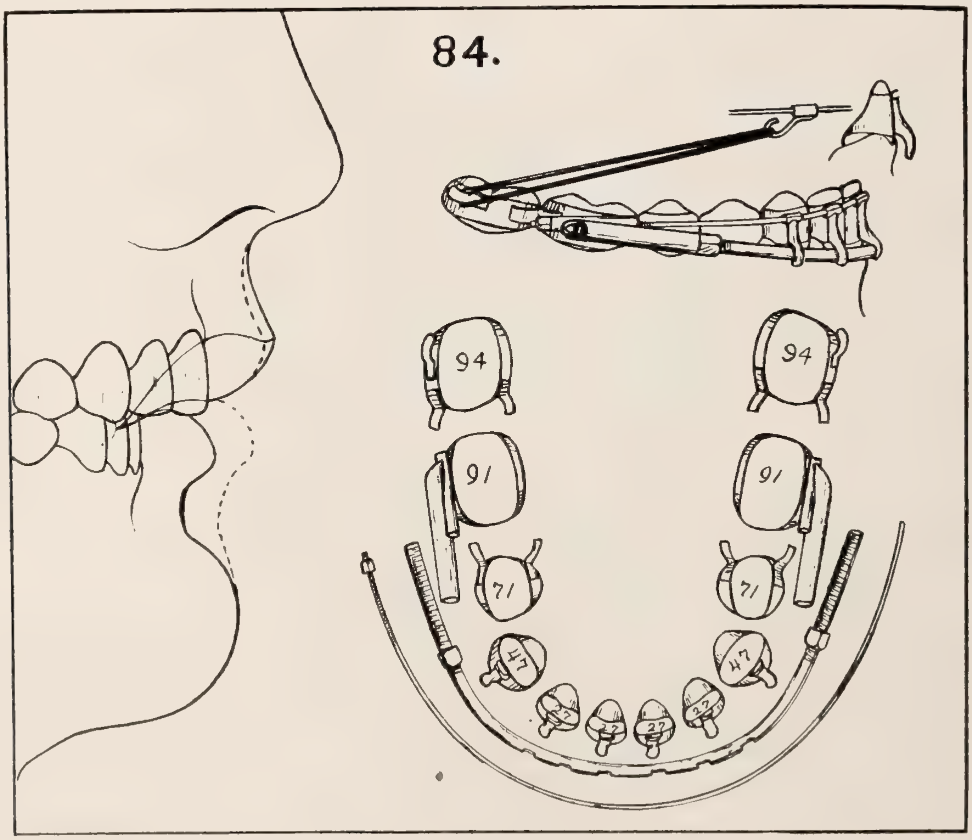
CHAPTER XXXVI

Type B. Class III

PRONOUNCED RETRUSION OF THE LOWER TEETH WITH UPPER MODERATELY PROTRUDED

Slight upper protrusions accompanying **pronounced lower retrusions,** as illustrated by the drawing on the left of **Ap. 84,** are quite common. Because of the decided mesial malocclusion of the upper buccal teeth in relation to the lower, this and other irregularities having a similar occlusion have inexcusably been mistaken for upper protrusions.

Accompanying pronounced retrusions of the lower teeth, the upper may be in every gradation of protrusion, but in those cases where the cusps of the lower buccal teeth are in distal malocclusion the width of a bicuspid, the degree of the upper protrusion will be regulated by the extent of the lower retrusion.



Apparatus 84, which illustrates the contour apparatus for bodily protruding the lower labial teeth, is practically the same as **Ap. 87,** Class IV, where a detailed

description of its construction and application will be found; the only difference being, that in **Ap. 84** the power bow is No. 16, instead of No. 13. And in other particulars also in combination, provision is made for the application of a lighter force, as in the employment of incisor **bands 26** instead of **27,** as shown in the drawing.

Fig. 19.

In an extensive retrusion of the lower teeth where the lower jaw is not also retruded in its dento-facial relations, the chin will be "pointed" and appear prominent because of the pronounced deepening of the labio-mental curve below the lower lip. The lower lip in its habit of repose against the incisal edges of the upper teeth will often be curved forward, producing a defined lateral crease, marked by a darkened line of stagnated sebaceous ducts, commonly known as "blackheads." Fig. 19 is made from the casts of five cases of this type at the beginning of the operation and Fig. 20 shows one of these cases complete, which with Figs. 16 and 17, may be taken as fair samples of the result in occlusion in all cases of this type, and which is easily possible when the facial lines demand this method of correction.

Fig. 20.

In cases of this character all the lower teeth in the arch are commonly placed too far back in their relation to the mandible, which in itself may be in esthetic harmony; so that the real correction demands a **bodily** movement of the lower labial teeth and alveolar process to correct the facial outlines.

If there is an attempt to treat these cases with an uncontrolled reciprocal action of the intermaxillary elastics, the upper protrusion will doubtless

be properly corrected, and the lower teeth, as Dr. Angle says, "will be tipped forward to a normal occlusion." But such a decided inclination movement of the lower teeth will usually mar the perfect occlusion of the buccal teeth, especially that of the molars, whose inclination position permits occlusion only upon the distal cusps, which will always tend to drive them back to their former malocclusion until righted. The inclination position of the labial teeth also is not only unpleasant in appearance, but the retruded area lying over their roots marked by the deepened labio-mental depression is not corrected.

Therefore this character of movement should never be resorted to where an extensive bodily movement is demanded, unless it is intended to finally move the roots of the labial teeth forward with the **contouring apparatus 84.** This does not apply to those cases where the crowns alone are retruded, with a decided lingual inclination,— a condition that not infrequently arises.

An extensive protruding movement of the roots of lower incisors, however, has not been attended in the author's practice with the same success as the bodily protruding movement of the upper incisors; nor is it nearly as liable to carry the entire alveolar ridge along with the movement of the roots; in consequence of which they require to be retained very much longer for the upbuilding of their alveolar surroundings.

If the mesial movement of the lower buccal teeth demanded for normal occlusion is not more than one-half the width of a cusp, it may usually be accomplished for youthful patients with the ultimate preservation of occlusal contact of the molar planes. That is, the inclination which the extent of the movement at first gives to the molars will ultimately right itself if properly retained.

In the chapter upon **Principles and Technics of Retention** will be found described methods for continuing the application of the intermaxillary force long after the main work of correction is accomplished, by replacing the regulating apparatus with a retaining apparatus that is provided with attachments for the elastics; this appliance being placed frequently for this purpose even before the normal relation of the buccal occlusion is attained. When a considerable mesial movement of the lower buccal teeth is demanded, the inclination dip of the occlusal surfaces may be avoided by a slow movement extending over a number of years, or by the application of a sufficient force to retain the buccal teeth long enough to allow the natural forces to right the inclination. This will be found especially true during the early years of adolescence.

In Chapter XIV, Figs. 35, 36, and 37, are shown six typical cases of this type, selected from many which have been corrected without extraction in a similar manner during the past ten years of the author's practice.

Intermaxillary Force

The intermaxillary force is especially applicable as an auxiliary in the operation of protruding all the teeth of the lower jaw to correct a malocclusion and

restore facial relations. In its application, whether in reciprocation to a retruding movement of the upper teeth or not, great care should be exercised to prevent the **extrusion** of the molars — unless this movement be particularly demanded, as in close-bite malocclusions.

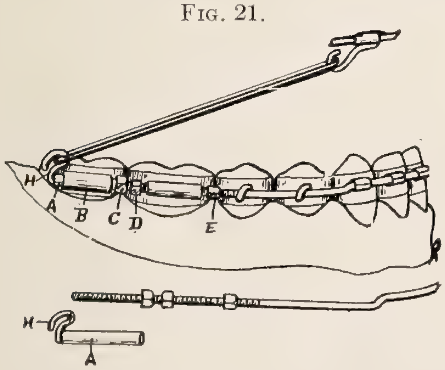
As most of the cases for which we are called upon to undertake these operations have erupted the second molar teeth, these should always, where possible, be included in the apparatus — not alone to reinforce the stability of the anchorages, but also for the important purpose of placing the attachment of the rubber bands at the most distal points in the mouth, in order to keep the force in a horizontal or mesio-distal direction as much as possible. To further prevent the extruding tendency of the intermaxillary force, the molar attachment should be anchored down, so to speak, and in a way not to materially interfere with the protruding movement which we have in view.

Intermaxillary Apparatus for Extensive Movements

Cases occasionally arise for which it seems desirable to utilize all of the intermaxillary force towards a protruding movement of the upper or the lower teeth, with little or no reciprocal movement of the opposing denture. Besides the act of uniting the teeth of one denture so as to retard or prevent a distal movement, the movement of the other may be increased without increasing the force by applying it to a few teeth at a time, as mentioned elsewhere.

In Fig. 21 the **dental bow** (Nos. 18 or 19, extra hard) engages with the labial teeth by means of the **open-tube attachments,** and passes under the **buccal hooks** of the bicuspids, and then through No. 18 tubes on the first molars; the threaded ends finally resting in telescope or **sliding tubes** A, within the **anchor tubes** B on the second molars. These tubes have thin walls (No. 32). To one end of tube A (shown disassembled), which is about one-tenth of an inch longer than the attachment tube B, is soldered a hook, H, as shown, for the attachment of the elastics. The ends of the bow are threaded to carry nuts C, D, and E, placed as shown. When the apparatus is in position, the nuts C and D are turned back against the sliding tube A, forcing it back until the hook H stands free from the distal end of the anchorage tube B, so that no forward pull is exerted upon the molars when the intermaxillary ligatures are attached. The force being directed wholly upon the bow through the medium of the tube A engaging directly with the nut C, the labial teeth alone to which the bow is attached are forced forward. As the sliding tubes are forced forward, the hooks H are prevented from coming in contact with the tubes B by means of the nuts C, which are turned back from time to time as the movement progresses.

Fig. 21.



When the labial teeth have been sufficiently protruded, the bicuspids are brought forward with rubber bands, wire or silk ligatures, attached to their buccal hooks and extended from one side to the other around in front of the labial teeth. During this movement it is well to keep the nuts C and E pressing against the tubes, in order to add the anchorage force to that of the intermaxillary. In fact, at any time the two forces can be used in conjunction.

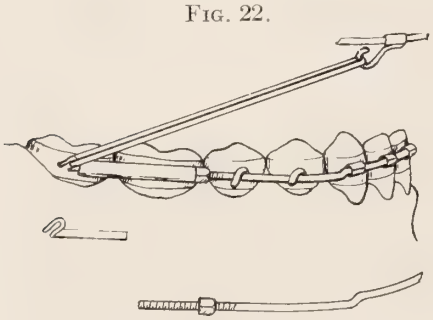
When the bicuspid position is corrected, the intermaxillary force is directed to the mesial movement of the first molars by turning the nut D forward against the distal end of the first molar tube and the nut C, as before. Finally, the second molars are brought forward with the intermaxillary force, by turning the nut C forward until the hook H attached to the sliding tube A engages with the distal end of the anchorage tube B.

From this lengthy description many will doubtless think that this is quite a complicated operation. Yet the construction of the apparatus requires no more skill — if one be supplied with the proper material — than others that appear far more simple; and when accurately fitted and in position, the fact that it contains in itself all the elements of complete and successful movements, the subsequent adjusting treatments are reduced to the minimum of time and difficulties.

The combination possesses many important qualities: the horizontal direction of the force, together with the rigid quality of the bow, held down by its engagements to all the buccal teeth and yet permitting a distal movement along its surface, increases the stability of the anchorage against the extruding tendency of the intermaxillary force when the mouth is opened; again, the possibility of applying all the force to a few teeth at a time, and means being provided for holding the positions gained while others are forced forward, is a great advantage.

A variation of the molar appliances of this apparatus is shown in Fig. 22, which will commend itself because of its greater simplicity and ease of construction and attachment, especially where the second molars are short or are not fully erupted. To the buccal surfaces of two-band stationary anchorages are soldered tubes for the threaded ends of a No. 18 protruding bow, to glide easily. Into the distal ends of the tubes are fitted short bars which are bent to form hooks for the intermaxillary elastics, the force of which is communicated to the distal ends of the protruding bow, through the medium of the hook bars. When the labial teeth and bicuspids are sufficiently protruded as before, the anchorages are replaced with separate molar bands with buccal tubes and with two nuts between the tubes for the mesial movement of the first molars; after which, by unscrewing the distal nuts the second molars are brought forward, as before, with the intermaxillary force alone.

Fig. 22.

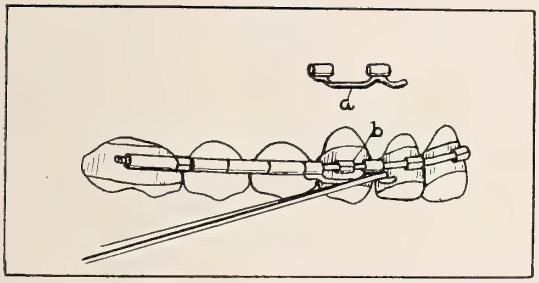


In the blending of the **Types A and B** there will arise the demand for a con-

siderable retruding movement of the upper teeth. If under any condition it seems advisable to first move the upper molars distally with the intermaxillary and occipital forces, with a view of following it later with a general retrusion of all the teeth in the attainment of a normal occlusion, the **intermaxillary span-hook** device, shown in Fig. 23, will be found applicable. The connecting wire "a" which unites the two tubes spans the cuspid attachment, thus making it possible to communicate the intermaxillary, and, if desired, the occipital force (the latter with the occipital bow "C") directly to the back teeth from a point in front of the cuspid attachment without exerting any force upon the cuspid. Of course, this could be accomplished by soldering the hooks to a rather heavy bow, but it would not be possible to change the force in a few moments from one tooth to the other by changing the intervening sliding tubes. The sliding and intermaxillary hook tubes should usually be made of seam tubing so that the force of intermaxillary elastics can be easily attached to any arch bow apparatus after it has been placed, and as readily removed or changed in its action.

With the combination shown in Fig. 23, nuts at the mesial ends of the short molar tubes should be kept screwed back hard to prevent the force from acting upon the front teeth, until the molars are moved sufficiently, after which it may be allowed to act upon the nuts, and through them upon the bow, for the retrusion of the teeth in front; or the cuspids and bicuspids may be moved back next. By removing one of the sliding tubes — the intermaxillary span hook will then slide back and engage with the cuspid attachment. In this way the nut can be used to retain the molar in the distal position which has been gained.

Fig. 23.



This apparatus in combination with the lower, arranged to move the teeth forward in sections as shown in Figs. 21 and 22, forms in its entirety an effective apparatus for producing a considerable disto-mesial movement of both dentures with a minimum degree of power.

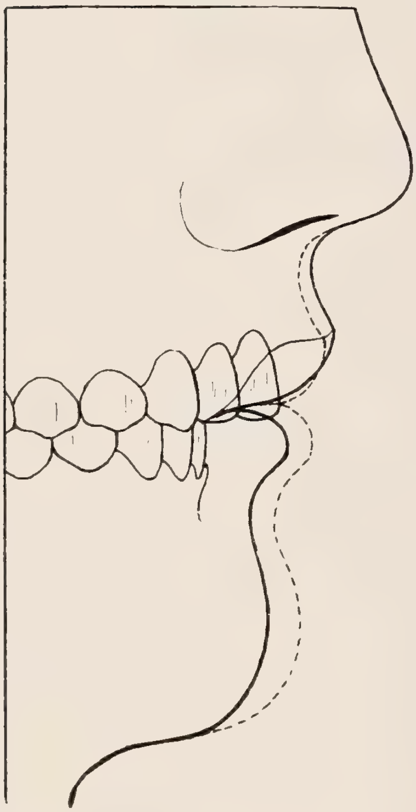
CHAPTER XXXVII

Type C. Class III

RETRUSION OF THE LOWER JAW AND TEETH

The present type refers to that class of malocclusions which are accompanied with a **retruded mandible,** with the lower lip and teeth in harmony with the retruded chin, as if the entire body of the mandible had been forced backward from its normal position, as shown in Fig. 24. Cases of this character differ quite decidedly in profile outlines and treatment from the other types of Class III in which the lower teeth alone are retruded, while the chin and the body of the lower jaw are in normal relations,—though in both characters the occlusion of the teeth may be exactly the same. Moreover, retrusions of the mandible, in the author's practice, have been found more frequently in connection with decided upper protrusions, and consequently this type may be considered as belonging more properly to Class II.

Fig. 24.



Inasmuch as the relative position of the chin varies in different individuals from decided prognathisms to decided retrusions, and as some form of this malrelation may obtain in connection with any other character of irregularity, we therefore find every gradation of this bodily retrusion of the lower jaw and teeth in connection with every gradation of protrusions of the upper teeth.

In a former classification "bodily retrusion of the lower jaw and teeth with upper normal" was placed by the author in one class, but as this is a somewhat rare dento-facial relation of the upper and lower dentures, and also as lower retrusions are closely allied to upper protrusions in occlusion, it has been deemed advisable to merge that class into a type of the present class.

Diagnosis and General Treatment

In all cases of marked disto-mesial malrelation of the upper and lower teeth one should always strive to prevent being deceived by a facial effect. Where the

mandible and contained teeth are decidedly retruded in their esthetic relations, the effect is usually that of an upper protrusion even when the upper lip is nearly or quite in normal relations to the balance of the features of the physiognomy.

For the perfect correction of occlusion and facial outlines, cases of this type really demand the operation known as "**jumping the bite**" which was introduced by Dr. Norman Kingsley in 1882. This consists in attaching an apparatus to the teeth, intended to force the lower jaw forward the desired distance, and to hold it there until Nature has so changed the temporo-maxillary articulation as to render it impossible for the jaw to ever go back to its original position.

In the Dental Review of May and July, 1894, will be found a complete résumé of the literature of "jumping the bite," with the author's description of the difficulties which would need to be overcome in a successful operation of this character, the whole intended to show the improbability of permanent success. After repeated and long continued trials to "jump the bite" with the most skillfully constructed apparatus, for a number of patients younger than 13, *all of which ultimately were failures*, and moreover as he has never seen from the hands of others a well authenticated case of correction by this method, the author now regrets to say, notwithstanding the operation has been recommended as practicable by a number of prominent orthodontists, *he cannot advise anyone to undertake it.*

On the other hand while it may be possible with this character of malocclusion to bring the teeth to a normal occlusion (without extraction) by a disto-mesial interstitial movement of the teeth with the intermaxillary force, this operation in all marked cases of Type C should not be attempted, because the lower lip not being retruded in relation to the chin, if forced abnormally forward by an extensive protruding movement of the lower teeth, which this operation implies, a receding chin effect would be inevitable. And in those cases where the upper teeth are considerably protruded, it would in all probability result in that most unhappy deformity, characterized by a **bimaxillary protrusion.**

In all cases, therefore, of a retruded lower jaw and teeth, accompanied with a protrusion of the upper, the extraction of upper teeth is indicated in order to be able to produce, as in all pronounced upper protrusions, the extensive retruding movement of the upper labial teeth to harmonize the facial outlines, with no protrusion of the lower lip and also for the least possible disturbance of the original masticating occlusion. Thus removing as far as possible the effect of a facial deformity without substituting for it another that would be nearly if not quite as bad, which undoubtedly would result from a reciprocal disto-mesial movement of all of the upper and lower teeth in an uncalled-for strife to produce "normal occlusion."

While a retruding movement of the upper labial teeth, even to the full width of a bicuspid, will not in marked cases of upper protrusions of this type, completely correct the facial outlines, on account of the deficient chin, the improvement is always an exceedingly pleasing one, and one moreover which is far more liable to

retain its position than the operation which requires a movement of all the teeth. In Figs. 41 and 42, p. 167, are illustrated and described four cases of this type.

It should never be forgotten that one of the indispensable conditions of permanent retention is an **accurate interdigitation** of buccal cusps. In nearly all cases of this type with a full complement of teeth, the upper buccal cusps will be found in mesial malinterdigitation, a condition which it is very important to retain. If, however, after producing normal width relations of the arches, it is found that the general mesio-distal relations of the cusps are imperfect in this particular, they should be intelligently shifted with the **intermaxillary elastics.** The depth of the labio-mental curve of the lower lip will at once indicate whether a forward movement of the lower teeth is admissible. Usually, in this type such a movement is not advisable, in which case the lower buccal teeth should be firmly united in **stationary anchorage bands,** and so joined to the front teeth as to prevent a mesial movement from the intermaxillary force. On the other hand, the force should be applied to the upper teeth at points which will produce the easiest movement with the least display of power.

In this connection it may be stated as a fact that a retruding movement of the upper labial teeth, even slightly beyond normal relation, will produce a far more pleasing facial effect by placing the upper lip in closer harmony with the lower, than will result from a protrusion of the lower lip at the expense of obliterating the labio-mental curve, to say nothing of the possibility of producing a receding chin effect. It would be well to remember this in cases where the upper is but slightly protruded, or normal, in connection with a decided bodily retrusion of the lower jaw and teeth.

It will have been observed, that in the correction of this form of Type C, the rule for extraction is the same as in Type B, Class II. It is needless to say, also, that every device should be taken advantage of to avoid moving the upper anchorage teeth forward, and consequently the principal movement should be produced, if possible, by the **occipital force** alone, with an employment of the **stationary anchorages** mainly for the purpose of taking up the slack of the retruding bow, and to hold the position gained during the day times when the occipital apparatus cannot be worn.

In this operation the **intermaxillary force** will be a valuable and effective adjunct if the tendencies of its movement are properly controlled, and especially in cases that are complicated with a close bite malocclusion, because of the extruding force which the elastics will exert upon the lower buccal teeth whenever the mouth is opened.

CHAPTER XXXVIII

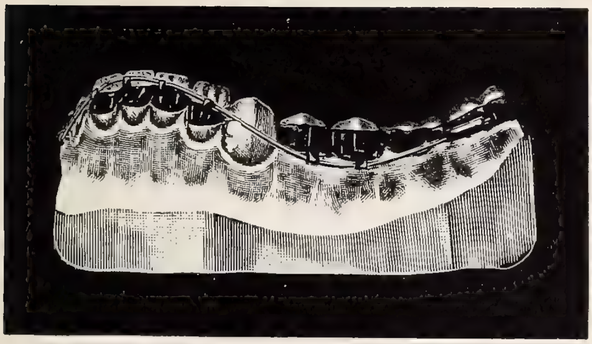
Type D. Class III

CLOSE BITE MALOCCLUSION

One of the most common characters of Classes II and III, and in fact, all irregularities in which the upper buccal teeth are in decided mesial malocclusion with the lowers, is a **close bite malocclusion** — the lower incisors often striking the gum well back upon the lingual aspect of the alveolar ridge. When the teeth occlude in this manner, any attempt to retrude the upper labial teeth will drive the lower incisors, upon closure, further into the gum. Therefore the first demand is to open the bite by extruding the buccal teeth and intruding the incisors.

At the meeting of the Illinois State Dental Society of 1892, the author presented a method for accomplishing this phase of the operation with a rubber plate worn in the roof of the mouth, which was published in the Dental Review, July, 1892. While the method has doubtless proven successful in other hands, as it did in many cases with the author, it became obsolete along with other regulating plates, upon the establishment of the method of attaching appliances to dental bands. Unfortunately, some of the recently published text-books continue to describe this old regulating plate as a thing of present value.

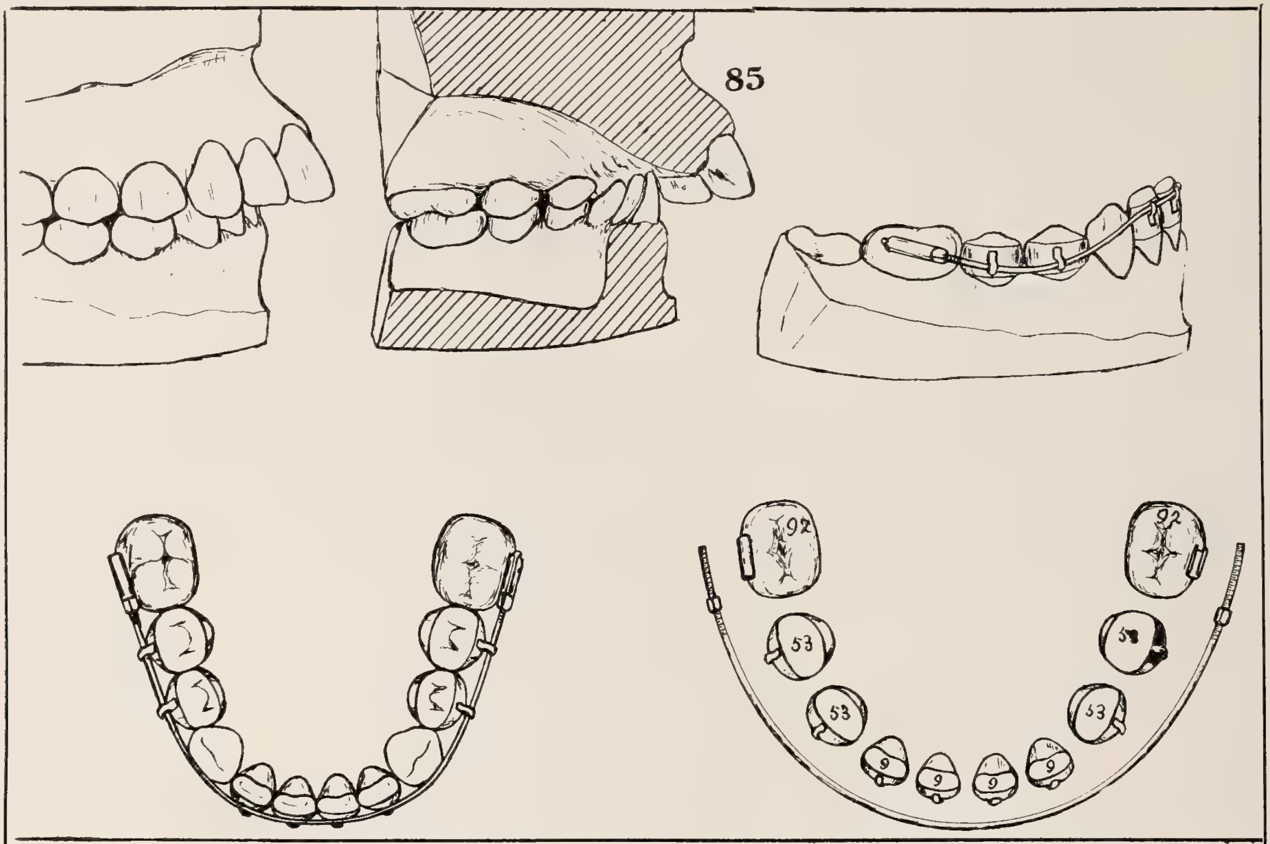
Fig. 25.

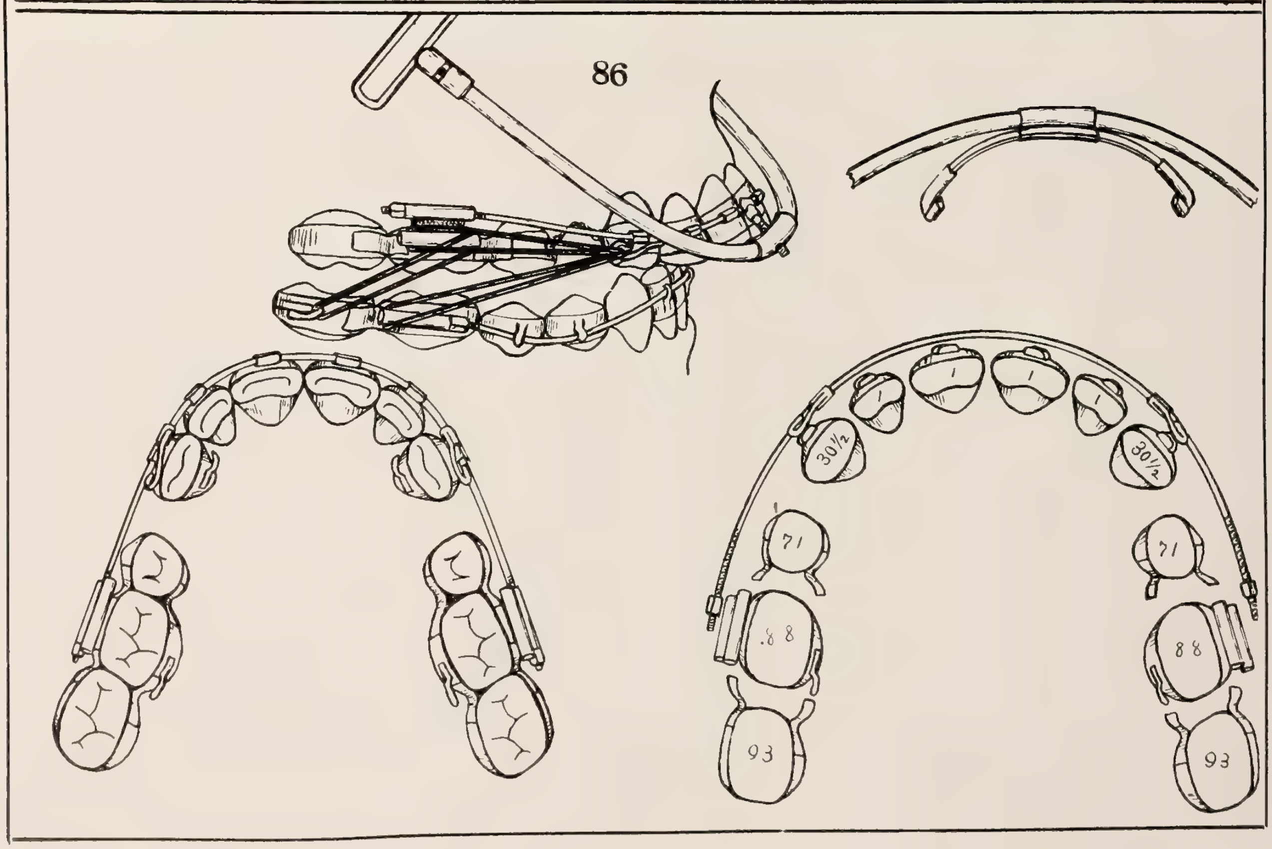


A number of years ago the author introduced another method that was illustrated with Fig. 25, which he is pleased to see has become one of the practically efficient methods in Orthodontia. By its application the difficulties of correcting this most annoying malposition of the teeth are removed.

Apparatus 85

In the most modern construction of the above-mentioned apparatus, **shell crowns (B. 92)**, instead of bands, are fitted to the first lower molars, as shown in **Ap. 85**. To the bicuspids and incisors are fitted **Bs. 53 and 9**. The relative position of the hooks and tubes when the bands are in place should be such that when a **resilient bow** No. 22 is sprung into the position shown by the buccal view of the apparatus, it will then lie closely in the attachments and exert an evenly distributed force, extruding the bicuspids to the new plane of occlusion


85
92
92
53
53
53
53
9
9
9
9


86
1
1
1
1
30½
30½
71
71
88
88
93
93

and intruding the incisors. In constructing the crowns they should be fitted to occlude perfectly with the opposing upper teeth, as the patient will be obliged to masticate upon them solely until the bicuspids are raised to an occlusion.

In cementing them, when one crown is driven to place, allow the patient to force the other to position to insure an evenness of occlusion.

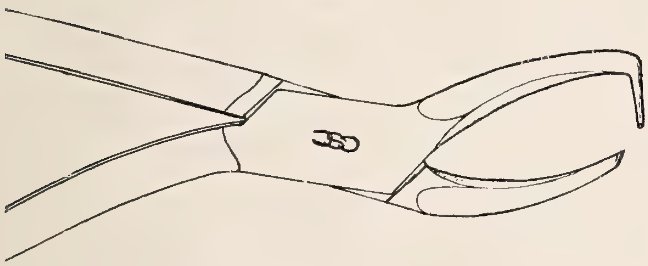
There are three ways of assembling the bow. First: pass the ends beneath the bicuspid hooks into the molar tubes and then raise the central portion to the incisor hooks. Second: with the bow resting in the molar tubes and incisor hooks, spring the sides down to the bicuspid hooks. Third: place one end in the molar tube, and from that point spring the bow into its respective hooks, and finally into the open tube on the opposite crown, shown in the disassembled apparatus.

It will be seen that the ends of the bow are threaded for nuts at the mesial ends of the molar tubes, an expedient that is often demanded for the enlargement of the arch to give relief to crowded bicuspids.

The immediate opening of the bite is accomplished by the crowns (B. 92). The first molars being the oldest and most solidly placed teeth in the mouth are well calculated to withstand the strain of mastication until the bicuspids are lifted and the second molars grow to an occlusion of sufficient stability to take their share of the work. When the sockets of these teeth have become solidified, the crowns and lower apparatus can be removed, whereupon the first molars will then grow to their proper occlusion. If it is found that this first opening of the bite is insufficient, the crowns may be removed intact and another layer of plate soldered to the occlusal surfaces.

The difficulty of removing the hollow crowns intact, or without slitting them, is now wholly obviated with the **crown lifting pliers** shown in Fig. 26. A small hole is bored in the occlusal surface of the crown which permits the point of the right-angled beak of the pliers to rest directly upon the natural crown as a fulcrum. The other beak engaging with the crown attachments or the gingival border of the crown itself, will readily lift it from its cement attachment to the tooth. The pliers are well adapted for removing all hollow crowns in the same manner.

Fig. 26.



The apparatus for retruding the upper labial teeth may be placed when the lower apparatus is attached, the bite being further opened during the progress of the case by the intrusion of the lower incisors.

In nearly all cases of this character the author utilizes the extruding tendency of the **intermaxillary force** upon the lower buccal teeth and the intruding tendency of the **occipital force** upon the upper labial teeth and alveolar process. The intermaxillary elastics are attached to the distal projecting ends of the lower bow

or to hooks soldered to the crowns for this purpose. This force will overcome the intruding tendency of mastication and the reacting force of the bow, upon the first molars.

Again, there is no irregularity for which the occipital force is more applicable than those of this character, because it can be made to exert partially an upward as well as a retruding force upon the upper incisors and incisive process, materially aiding in the required movement for opening the labial bite, necessary for the reduction of the upper protrusion.

Apparatus 86

The crowns may at times be dispensed with for young patients, with the expectation of commencing the lifting or extruding movement of the molars with the intermaxillary elastics, at the beginning of the operation.

In **Ap. 86** a two-band stationary anchorage is attached to the molars, with provisions for the attachment of elastics as shown, and for the bow to extrude the bicuspids, etc. This arrangement is particularly applicable for the correction of close bite malocclusions in Class II, where little or no mesial movement of the buccal teeth is desired. For cases in Class III single bands upon the first and second molars with short buccal tubes for the bow, would permit a mesial and extruding movement. The intermaxillary elastics passing more directly from one jaw to the other are calculated to exert a direct extruding force upon both the lower and upper buccal teeth.

The occipital bow A, shown in position, may be exchanged for occipital bow C, shown on the right, if a more direct retruding force upon the cuspids is demanded.

Short Bite Malocclusion

A very rare character of **Bimaxillary Intrusion** has fallen under the author's observation for treatment. Though it differs quite decidedly from the typical close bite malocclusion, it is mentioned in this connection because it required similar methods of treatment. It consists in all of the teeth, both front and back, being quite decidedly too short in relation to the occlusal plane of perfect dento-facial harmony. In other particulars the teeth may be in fair alignment, antero-posterior relations, and occlusion, and when the jaws are held apart, with the lips in esthetic pose, or while talking or laughing, one would hardly imagine the existing state of malposition. But when the jaws are closed with the buccal teeth in occlusion, the physiognomy is at once disfigured by an expression of maturity as in an edentulous patient; which is due to the unesthetic shortness of the distance from nose to chin and the apparent redundancy and superabundance of labial and buccal tissues. See Fig. 27.

In this case the difficulty of occluding the teeth, with the production of a painful disturbance at the temporo-maxillary articulation, led to imperfect mas-

tication of food, which was accomplished principally with the incisors alone. On the left, in Fig. 27, is shown the profile cast, with the teeth in masticating occlusion. I regret that it does not fully express the facial disfigurement which was far more pronounced than a photograph of the facial cast indicates.

Fig. 27.

The impressions for the casts shown on the right were also taken at the beginning of the operation for the purpose of showing the amount of extruding movement that would be necessary to produce a proper facial effect. For this purpose modeling compound was placed between the teeth and the jaws carefully closed to the desired position, at which point the facial impression was taken. Then the modeling compound bite was removed from the mouth and the dental casts were placed in it and fixed in that position as shown, from which the illustration was made. The proportionate excess of the lip tissue would have permitted the jaws to have been opened still wider without disturbing the ease of a perfect closure of the lips.

Fig. 28.

The apparatus which was first attached consisted of four crowns placed upon the first molars, which opened the jaws to about one-half the desired extent, to start with. The bicuspids and labial teeth were all banded with attachments to support **alignment arch bows** with spurs for the attachment of the **direct intermaxillary elastics,** so as to extrude

all of these teeth with a uniform movement, treating the case in this particular as though it were an open bite malocclusion. Provision was also made for the attachment of the disto-mesial intermaxillary elastics for the purpose of closing the interproximal spaces, and correcting the occlusion by a retruding movement of the upper labial teeth and a mesial movement of the lower buccal teeth.

Within a few months all of the intruded buccal teeth (besides the crowned molars) were observed to be in perfect occlusion, whereupon the lower crowns were removed and an added layer soldered to their occlusal surfaces. These being replaced with a continuation of the several forces for a few months, with a second complete closure of occlusal planes; then the upper crowns were treated in the same manner, etc., etc.

In this way the teeth were gradually moved to the desired new occlusal plane, which was not in the sense of pulling them *out* of their sockets, but with an apparent concomitant movement of the surrounding gum and alveolar process. It was at this point in the operation that the casts shown in Fig. 28, were made.

The regulating apparatus was now changed for the more delicately constructed and less unsightly retaining apparatus as shown in Fig. 25, p. 389. When assured that the positions of the extruded buccal teeth are permanent, the crowns will be removed from the first molars and replaced with bands bearing hooks for the direct application of intermaxillary elastics to finally extrude these teeth to the new plane of occlusion.

CLASS IV

RETRUSION OF THE UPPER TEETH

Table of Types

Type A. RETRUSION OF THE UPPER DENTURE

Type B. RETRUSION OF THE INCISORS WITH BUCCAL OCCLUSION NORMAL

Type C. CONTRACTION OF THE ENTIRE UPPER ARCH

Type D. RETRUSION OF THE UPPER TEETH WITH PROTRUSION OF THE LOWER TEETH

Type E. RETRUSION OF THE UPPER WITH PROGNATHIC MANDIBLE

CHAPTER XXXIX

INTRODUCTION AND GENERAL DIAGNOSIS OF CLASS IV

The subject of **upper retrusions** is quite as important in Dental Orthopedia as **upper protrusions,** because nearly as many patients present for treatment with some form of this character of dento-facial irregularity.

As pointed out in Dento-Facial Diagnosis, Chapter XV.: — upon the presentation of an irregularity of this class, the first mental impression produced upon a casual or untrained observer is, that the lower jaw is protruded or prognathic; whereas in a large proportion of the cases this will be a misleading effect, due principally to a retruded malposition of upper teeth and consequent depression of the central features of the physiognomy.

There are a number of causes which operate to produce this condition. One of the most prolific of the local causes is the early inexcusable loss or injudicious extraction of permanent teeth, usually by dentists who hardly realize the harm that may follow. The first permanent molars are frequently extracted because of extreme decay, under the belief that their places will soon be filled by the second molars, and that the third molars taking the position of the second will be more than usually strong and valuable. All of which would be good argument if the trouble stopped there, or if it were practiced only upon youths who were threatened with **protrusions** of the said denture. The author has in his collection the casts of many cases in which the early extraction of the upper permanent teeth had caused the incisors to become inlocked back of the lower front teeth, which in turn had prevented the forward growth development of the adjoining incisive bone that supports the upper lip and lower portion of the nose, with the ultimate production of decided facial imperfections.

Commonly the bicuspids and sometimes even the lateral incisors are extracted

because of the maleruption of the cuspids. Fig. 28, p. 150, shows the after effect of the early extraction of the upper first bicuspids; and Fig. 29 the after effect of the early extraction of the upper lateral incisors; both of which will serve to illustrate the consequences that follow this sort of malpractice. Occasionally

Fig. 29.

dentists are so unmindful of common-sense principles as to extract teeth from crowded arches for patients, whose dentures are already so retruded in their dental and facial relations, that it would seem that a child would know better. They do this because they find the teeth badly malposed, and seem to be unaware of

Fig. 30.

the fact that the alveolar arch can always be sufficiently enlarged to place all the teeth in alignment if demanded, however jumbled and overlapping. By extracting teeth from arches that are already retruded or even normal, they rob the case of an opportunity for perfect restoration, unless artificial teeth are ultimately

inserted to take the place of the lost ones to retain the corrected arches. This is well shown in Fig. 29, p. 153.

One can hardly calculate the amount of retruding force, exerted by the labial muscles upon the upper teeth which is especially exhibited after the early loss of teeth that sustain and give integrity to the arch, during the age of adolescence.

Fig. 30 illustrates a condition which followed the early extraction of an upper first molar, permitting the teeth upon that side to become so retruded that the labial teeth closed back of the lower, which was the cause of such a general lack of development of the alveolar framework, the case had every appearance of a prognathic mandible. In fact, it was diagnosed as such by supposed experts at the International Congress of 1900 at Paris, where a headgear apparatus with chin cap was supplied in a fruitless effort to retrude the lower jaw. I have been assured that at the time when the molar was extracted, the upper front teeth closed well over the lowers, and that there was "no appearance of a protruding chin." Which means of course that there was no retrusion of the upper. The case was corrected as shown at 19 years of age.

In addition to the complexities which arise from injudicious extraction of the permanent teeth, there are several quite distinct types of this class of malocclusion, each one of which is more or less characterized by the causes which have brought about the result.

The author has endeavored to present every type of this class from cases in practice, because the peculiar treatment which is here advocated is at present probably the least understood and appreciated of anything in Dental Orthopedia. Moreover, the author of a recent text-book upon Orthodontia gives it as his opinion that the protruding and retruding movement of the roots of the labial teeth "is of uncertain utility, wholly unnecessary." It is hoped the time will soon come when this and other equally false teaching will be exposed by the clinical results of advanced scientific practice.

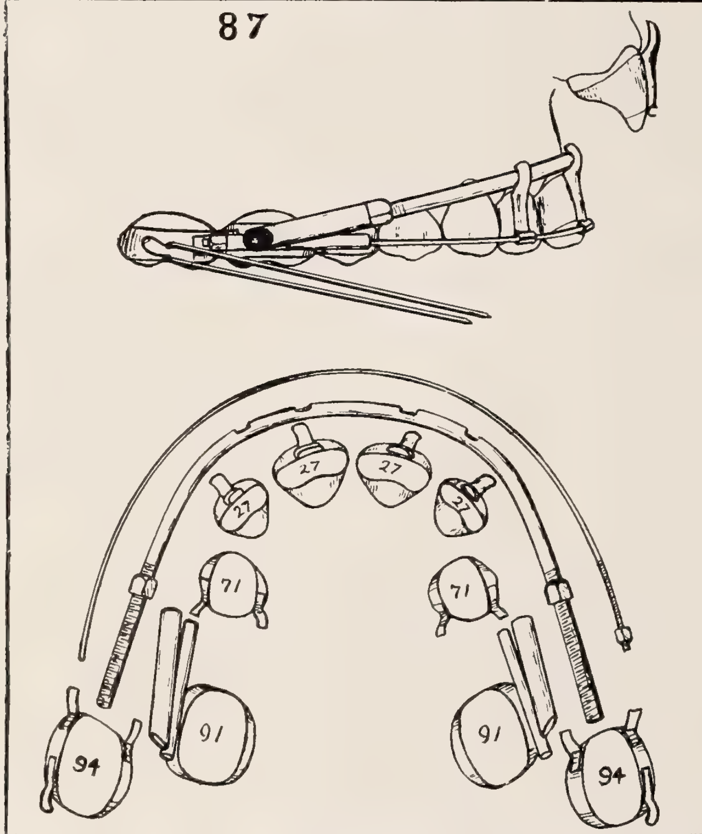
CHAPTER XL

THE PROTRUDING CONTOUR APPARATUS

Apparatus 87

As nearly all irregularities of this class demand a protruding movement of the upper labial teeth, with the view of carrying forward with the roots the labial alveolar ridge and incisive process, it is of the greatest importance that every detail in the modern construction and application of the only apparatus calculated to effectively perform this work should be fully understood, as upon this will largely depend the real success of the operation.

87



The drawing represents the regular **Protruding Contour Apparatus,** adapted for all pronounced cases of this class where a considerable bodily protruding movement of the upper labial teeth is demanded. The scientific principles of movement accomplished by this apparatus are fully explained in Chapter VI, under the head of Bodily Movement, p. 79.

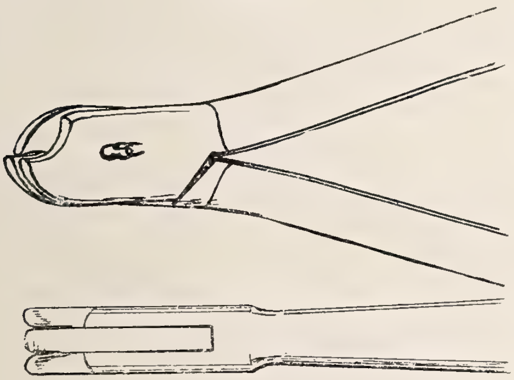
In this apparatus the **power bow** is No. 13 extra hard German silver. The rootwise bar attachments on the incisor bands are also cut from the same size of wire, and are formed to receive the force of the bow above the gingival borders. In the main particulars it is similar to **Ap. 82,** Type D, Class II, and **Ap. 84,** Type B, Class III.

For the construction of the anchorages, see "**Stationary Anchorages,**" Chapter VII, and then turn to **B. 91** for directions in placing and soldering the fulcrum and power tubes, the needs of which were pointed out in **Ap. 82.** Provision should always be made for the attachment of the **intermaxillary elastics** at the distal extremities of the anchorages. If the second molars have erupted, these teeth should be joined to the anchorages for the attachment of the buccal hooks

as shown. Otherwise, the elastic bands are looped over the distal ends of the fulcrum tubes. For construction of the labial bands, see **B. 27.**

The teeth should be properly separated, and each finished band and anchorage so perfectly fitted that it can be easily forced on and off with the aid of a wood plugger and band removing pliers, shown in Figs. 58 and 59, Chapter IV, to make slight but necessary changes in the shape or position of the attachments or power bow. The **power bows** for extensive movements are always No. 13 extra hard. They should be bent, first upon the model and finally at the chair, to conform to the shape of the arch, and their ends to lie evenly in the **power tubes** without the slightest tension. In the final moves of this important requirement, place the **anchorages** in position and the **power bow** with the threaded ends lying along the outside of the tubes. Then place the right end in its tube and see that the other lies exactly parallel with the left tube and in proper shape and position in front. Then place the left end in its tube with the other end free, and go through the same movements. This may require repeating several times with the greatest nicety of judgment and patience in detail, before you are able to assemble the bow and anchorages properly together. The heavy **bending pliers,** Fig. 31, are indispensable for this operation.

FIG. 31.

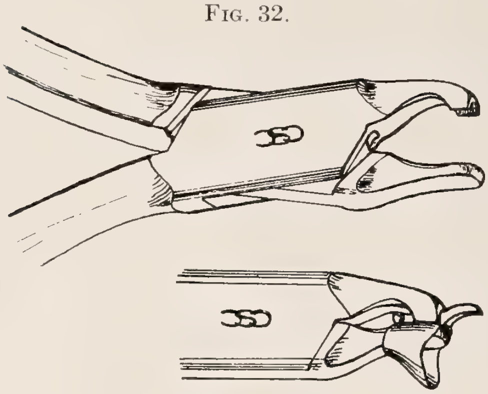


In assembling the **power bow** with the **anchorages,** after it has been properly shaped, insert one end in its tube with the anchorage in place, then slip the tube of the other anchorage on to the free end of the bow and force it to place on the teeth. These movements should be observed in the final cementing of the anchorages, as it would be impossible to place the rigid bar otherwise. In the preliminary assembling, after the anchorages and bow are properly placed, the labial bands which have been previously fitted to the teeth are placed in position, with their rootwise extensions resting over the bow. It may be found at this time that the bow will require lifting or lowering slightly by bending it at the sides while in position, to bring it to the exact position to be clasped by the extensions. The latter will also usually require bending and filing to fit them to the requirements of the bow. The ends are filed on the gingival side to a flattened taper, which should extend a trifle beyond the bow with a slight lingual curve, to aid them in retaining their position under tension.

In the shaping and fitting of the rootwise attachments and bow, the greatest care and consideration should be exercised. First, the **bands** for extensive movements should extend nearly to the highest gingival border of the gum, and from that point the **rootwise extensions** should bend forward so as to freely clear the borders of the gum, and then back to a position to slightly overlap the **power bow.**

The difficulty of bending the rigid **extensions** to a sharp angle, if necessary, without injury to their band attachments may be overcome by using the special pliers shown in Fig. 32, which is made to firmly clasp the band and its attachment, while the **extension** is given the desired shape with pliers and file. Second, the **power bow** should rest slightly above the highest marginal points of the central incisors and, in the final fitting, conform to the shape of the gum, but freely clear its surfaces. This is very important as the natural swelling of the gums in the operative action will be greatly increased by any undue pressure of the bow. Should this be found to be a fact at any time during the operation the labial bands should be removed, and the **extensions,** upon which the relative position of the bow to the gum depends, should be bent forward so as to free the bow from its imbedment in the swollen gum. Third, in the original shaping of an upper power bow it will be usually advisable to curve it downward at the median point to prevent it from interfering with the free action of the frenum.

Fig. 32.



Before removing the temporarily assembled apparatus, the bow should be marked on each side of the respective **rootwise extensions,** for guide markings to cut the **square grooves,** shown by the drawing, in which the extensions rest while in action. In the final cementing of the labial bands, they are simply carried to their respective positions on the teeth and bow. The fitting and placing of the **fulcrum bow,** No. 22, is the same as for any of the small alignment bows which are threaded at one end.

Treatment Adjustments:— In applying the force which is to follow the first conscious tension of the nuts, the large nuts of the power bow should be given about two quarter turns three times a week. As the movement advances it will become necessary to unscrew the fulcrum nut occasionally to allow the incisal zone to move forward with the roots. If the roots are found to be moving dangerously fast for the safety of their vitality, the application of force should be stopped in the power bow, and if necessary the nuts may be unscrewed slightly. Unscrewing the nut upon the fulcrum bow is also equivalent to reducing the force upon the roots. It may be advisable to cut and remove the fulcrum bow entirely, to be replaced with a new one when the danger is past. The danger line will be indicated by unusual sensitiveness to heat and cold over the root or roots of the affected teeth, which should not be allowed to arrive to a continual pain. Perfect rest should be afforded to the teeth and the gum painted with strong tincture of iodine, two or three times a week until all irritation subsides.

Those who have followed closely the directions will realize something of the difficulties and skill necessary for the perfect accomplishment of bodily moving

the labial teeth for the correction of facial contours. The author wishes to say that unless the operation is considered of sufficient importance to give to it the same painstaking skill that is demanded in other branches of dentistry, it had better not be attempted, as in all probability it will prove a failure. This refers not alone to the construction and application of the regulating apparatus, but to the construction and attachment of the proper retaining appliance that is intended to permanently sustain the position gained. On the other hand the truly wonderful work which this single apparatus has accomplished in the author's hands, attested now by hundreds of cases, proves to him that its work in other hands will cause this principle to live and grow in favor.

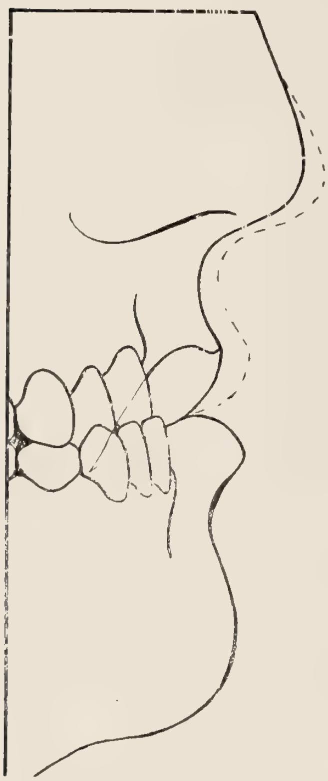
CHAPTER XLI

Type A. Class IV

RETRUSION OF THE UPPER DENTURE

One of the most characteristic and common types of this class of irregularities is that in which **all of the upper teeth are retruded** in their dento-facial relations:—the malposition seeming to involve the entire alveolar ridge and superior maxilla. The cause of this condition can usually be traced to direct type inheritance, and consequently while it may be corrected with the same ease and perfection as other cases, its retention should be prolonged to a far greater extent, else it will partially or wholly return to its former malposition. The teeth are commonly in perfect alignment in the respective arches, but with the upper denture sufficiently retruded to inlock the labial teeth back of the lower incisors and cause the buccal cusps to occlude not only distally to normal but in the sulci of the lower teeth instead of on the buccal aspect. Because of this, the distal malocclusion of the upper buccal teeth is rarely as defined in a malinterdigitation of the cusps as with mesial malocclusions of the upper.

Fig. 33.

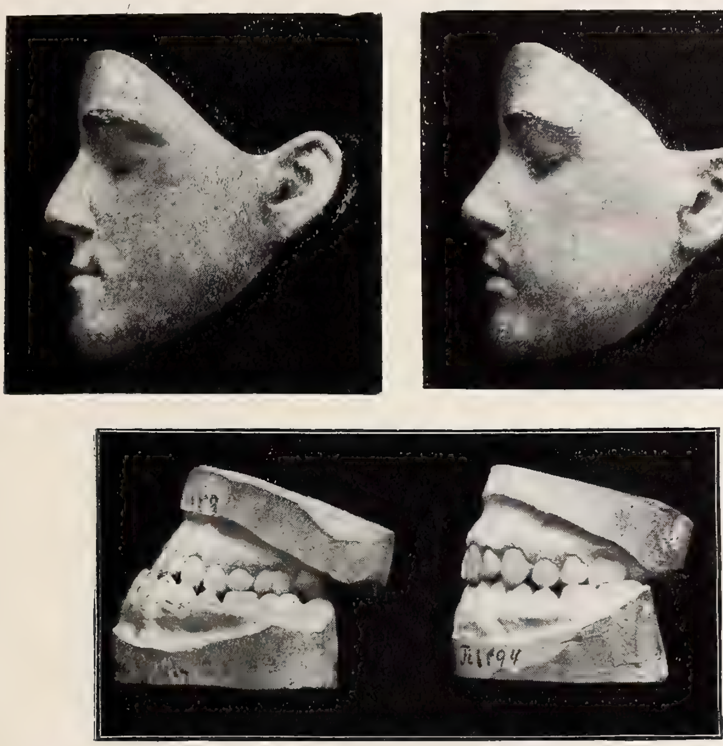


The general retrusion of the upper teeth and overlying facial outlines commonly produces the marked effect of a prognathic mandible, and while this is in many instances a concomitant condition, the correction of the upper is none the less demanded, and when properly accomplished will be of equal satisfaction. Moreover, it will be found in many instances that the mandible is not protruded when the upper is corrected, or at least the prominence of the chin does not mar the facial beauty.

Fig. 34 is a fair type of this class. The finished dental models of this case shown in the illustrations represent the true relations of the upper and lower teeth in occlusion immediately after the removal of the contouring apparatus. It will be seen that the relations and inclination of the labial teeth are perfect, but that the points of the cusps of the buccal teeth strike one upon the other. As described in "Principles of Retention," the retaining appliances for these cases should always possess provisions for a continuation of the intermaxillary force, to correct the final imperfections of malocclusion and aid in the retention

of the labial position. As this case was one of the earliest of its character in the author's practice, the importance of the intermaxillary auxiliary in retention had not been discovered, nor were the appliances for the firm retention of bodily moved teeth constructed as perfectly as they were later; nor was

Fig. 34.



there an appreciation of the length of time that the teeth should be artificially retained. I have never seen the case since its first correction, which was probably due to social duties and distance of location, but I am sorry to say, after obtaining such a beautiful result, which may have been permanently retained, that I have been informed "the teeth all went back." I can now more fully understand after a number of experiences of this nature in my early cases of this character, how this finale was most natural under the circumstances, and which may have been wholly due to the inadequacy of my retaining appliances and the deprivation of those principles of retention which are now considered imperative. Yet, notwithstanding the importance of advanced treatment, I more fully appreciate,—as all must who have had much experience in the correction of inherited irregularities, — the statement published by Dr. Kingsley twenty-five years ago, that "certain cases, however perfectly corrected and retained, will return to their former positions whenever the appliances are removed."

In a few cases of inherited types, mostly of this class, among males, which at 12 and 13 years of age showed no prognathism of the lower jaw and teeth, and which were perfectly corrected in facial outlines and occlusion by a bodily protruding movement of the upper teeth, there came a time, in later years

of development, when the mandible seemed to grow much faster than the other bones of the physiognomy, and thus assumed the inherited type of prognathism in spite of everything that could be done. Nor was this due, even partially, to a return of the upper teeth toward their former retruded position, which would indicate, in some instances at least, that latent inherent growth tendencies are most active in the later years of adolescence.

Fig. 35.

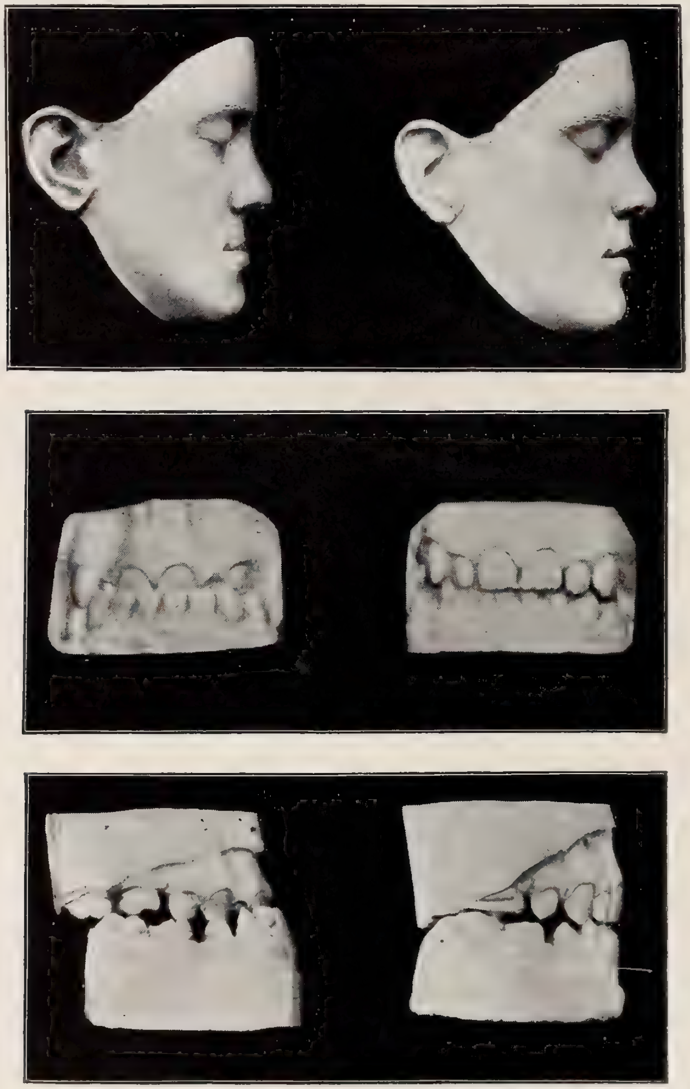
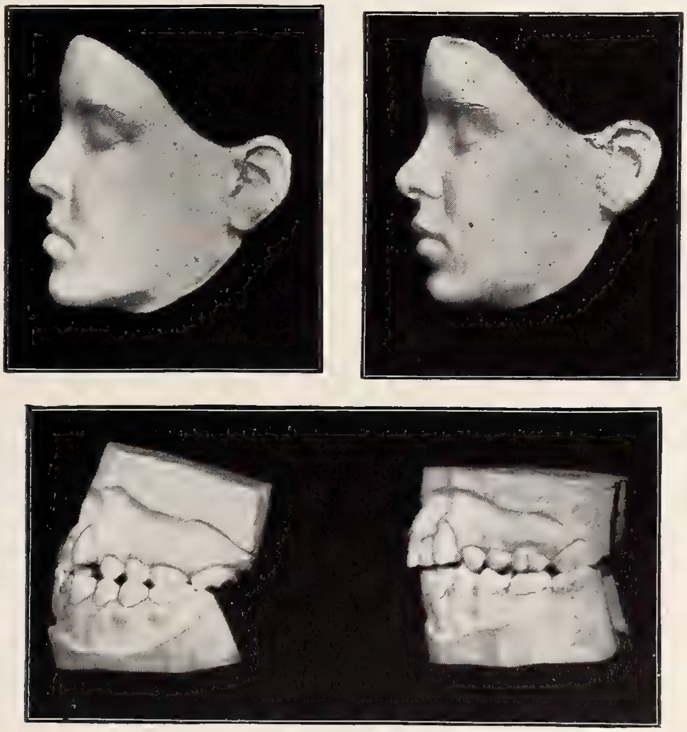


Fig. 35 illustrates a case of this character, which was corrected as shown at 14 years of age. The late Dr. George H. Cushing, who was intimately acquainted with much of the earlier work of the author, was asked to open the discussion upon a paper read before the Tri-State Dental Meeting at Detroit in 1895, at which the above case with others was presented. Coming from "Uncle George," who will always be revered for his honesty and ability, it is a pleasure to republish his words founded upon close clinical observation of the treatment of dento-facial deformities.

"Dr. George H. Cushing, Chicago: I am not aware that there can be much discussion upon a paper of this character. I do not know that there are any technical objections to the position that the paper assumes, as to the possibility of moving the teeth **in phalanx bodily,** the sockets as well as the teeth. If there are any such objections, they must fall before the positive evidence of clinical observation. I think the paper shows conclusively that, as Dr. Farrar remarked, 'this demonstrates an era of advance in orthopedic surgery.' I think we are most indebted to Dr. Case for an intelligent study of the mechanical principles which govern the movements of the teeth by applied force, in connection with the fact which he has demonstrated, of the possibility of moving the teeth and the processes together. You have seen what he has accomplished, and these models and drawings speak more eloquently than any language can express.

Fig. 36.



"Two of these cases I have seen under treatment from the first. I cannot begin to tell you the extent of the improvement in the facial expression of Fig. 36.* The maxillary bone and the process were so receded that there were depressions each side of the median line so deep that you could lay your finger in them. Those are now very nearly two-thirds obliterated, I should think, and though this mask shows a wonderful improvement, it does not show fully the great change which has been effected, although he has told you, that this was one of the cases so difficult to manage because of the rapid absorption of the process from the pressure of the roots. I think he hopes in time to entirely obliterate the deep depression under

* Fig. 36. The case which Dr. Cushing first called attention to is that of a girl about 16 years of age.

the alæ of the nose. From my observation, so far as the case has progressed, I have no doubt that he will succeed.

"Of the other case (Fig. 35), I may say that these casts, especially, do not begin to show the improvement that has taken place in the short time in which the patient has been under treatment. The boy presented a very disagreeable aspect, as you see here. There is one feature of the case which the author of the paper did not refer to. I do not know whether it passed his mind or not, but it is a feature which is very striking. The boy had a habit of dropping his mouth open continually. He does not do this at all now. I do not know why the movement of these teeth and the contouring of the face by this application of force should have produced that change, but it is a fact that it has. The boy now keeps his mouth closed as other people do. With his chin apparently protruding, owing to the lack of development of the superior maxillary, and the mouth open all the while, you may imagine how very unpleasantly he must have presented himself to his friends. He is now a pretty respectable looking boy, and he was very far from that when he first went into Dr. Case's hands."

Notwithstanding the perfect result shown in Fig. 35, and the permanency of retention of the upper teeth which was finally sustained with a bridge denture constructed by Dr. Cushing, at 16 years of age the mandible commenced to develop unusual proportions, which at 19 years of age had carried the occlusion of the lower labial teeth again 'way in front of the uppers. When this unanticipated movement commenced I again attached the upper contouring apparatus with its auxiliary, the intermaxillary force, hoping that an additional forward movement of the upper teeth with a retruding movement of the lowers would correct the condition; but I soon found that this was impossible because of the pronounced prognathism which the mandible was forcibly assuming.

There is one thing in relation to this case which should be mentioned as it has some bearing upon the question of late mandibular growth. In the original position of the teeth before treatment, when the jaws were brought together in masticating closure, the relation of the front teeth was such that the mandible was forced somewhat forward of its normal position in its temporo-maxillary articulation, in order that the cutting edges of the lower front teeth could pass those of the upper and thus bring the cusps of the buccal teeth into occlusion. In this occlusion, as shown by the dental casts, the upper incisors were nearly hidden behind the lowers, whereas in an incisive closure, the cutting edges came together with the lower but slightly in front of an even position with the upper.

When the impression for the first facial cast was taken, the teeth — as in all cases — were placed in masticating closure, consequently the illustration shows a more pronounced malrelation of the upper and lower facial lines than would have appeared with an unobstructed closure of the jaws. In the final facial cast, the mandible being allowed to go back to its normal position had perhaps quite as much to do with the correction of the facial outlines as other movements.

All persons of observation have noticed, in connection with the almost phenomenal sudden growth of some boys during the maturing years of development, that certain features of the physiognomy — principally the nose — which up to 14 and 15 years of age was comparatively small and immature, at 19 years of age "was just like Dad's,"— large, angular, prominent, etc.,— apparently outgrowing surrounding features to assume the full inherited type. Several cases in practice prove this to be true also of the mandible.

Fig. 37.

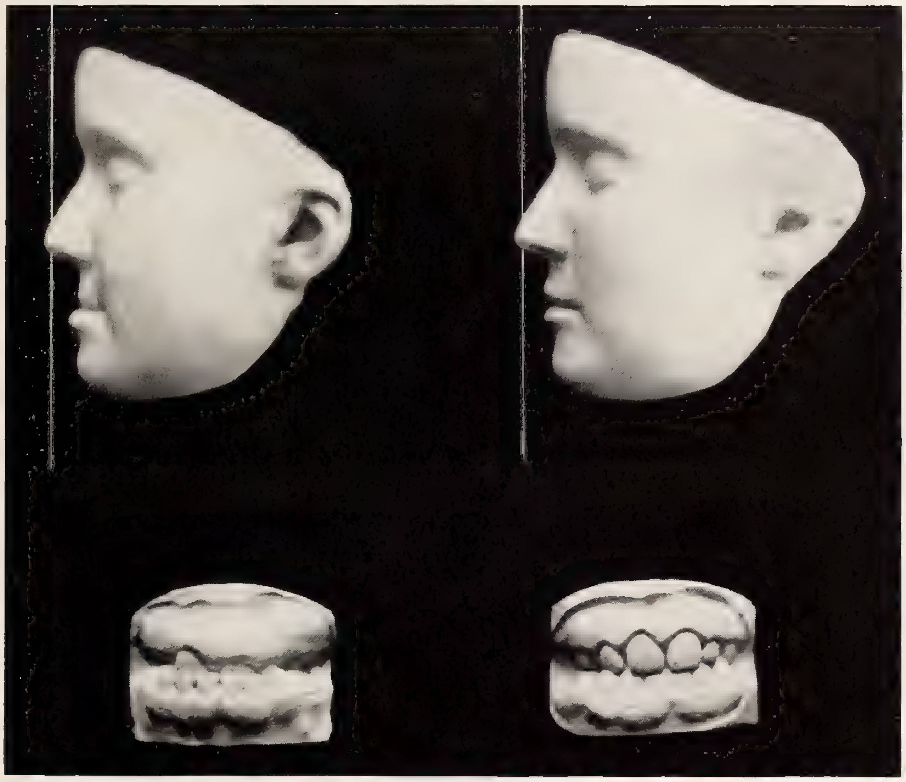


Fig. 37, which is characteristic of Type A, is presented to show the mature expression which may be produced on the physiognomy of a child of 12 years of age by a retrusion of the entire upper lip and lower portion of the nose, with a concomitant deepening of the naso-facial lines.

In the operation of correction, the lower lip and teeth which were in harmony with a normally posed lower jaw, were not retruded in the slightest degree. The profile casts are also interesting because of the peculiar facial effect of the intermediate stage of the operation shown in Fig. 47, p. 178, as compared to the beginning and final. In the latter, note the change in position and shape of the nose. When the operation began upon this case, although at about 12 years of age, the deciduous cuspids and molars of both the upper and lower were still in perfect position and solidity. The first upper permanent molars were more than the width of a cusp in distal occlusion. Considering the exceeding shortness of the

crowns of the incisors which prevented a long-bearing band attachment so desirable for the requirements of applying force for the movement of the roots, the movement was much slower than is usual for patients of this age, the whole operation, as shown by the illustration, requiring about two years. When the contouring apparatus was finally removed, the upper bicuspids and second molars had erupted; the deciduous upper and lower cuspids, and lower deciduous molars still remained. The first upper molars were moved distally somewhat, while the first bicuspids were placed nearly in positions of normal occlusion with the lowers. The intermaxillary force which was employed in this case from the start as an auxiliary, was continued, to fully correct the positions of the first upper bicuspid and restore the molars to their former interdigitating occlusion. The second bicuspids were allowed to take intermediate positions to be used as piers for the final retaining bridge denture.

Frequently the extent of the protruding movement demanded for the labial teeth to correct the facial inharmony is so great that it is inadvisable to attempt a mesial movement of the buccal teeth to close the spaces and produce a typically normal occlusion. In fact, the reaction of a protruding force, in spite of the strong intermaxillary reinforcements, will commonly retrude the buccal anchorage teeth, thus increasing their natural distal malrelation. And as it is always absolutely necessary for permanency of retention to sustain the position gained by the incisors, if the teeth are not moved forward for this purpose, artificial teeth should be inserted.

In all cases the cuspids are moved forward as soon as spaces commence to open distal to the lateral incisors. This is usually accomplished with lingual push bars which rest in tubes soldered to the anchorages. If the movement required is not great, rubber or silk ligatures attached to labial hooks and passed from one to the other over the fronts of the incisors will be sufficient. Usually the first bicuspids are also brought forward in the same manner in order to place the artificial sustaining teeth,— if inserted,— as far back in the mouth and out of sight as possible. In some cases, however, in the author's practice, with adults, he has found it necessary to insert two artificial teeth upon one or both sides of the upper arch, to retain the position of an extensive protruding bodily movement of the labial teeth for the greater perfection of facial contour.

CHAPTER XLII

Type B. Class IV

RETRUSION OF THE INCISORS WITH BUCCAL OCCLUSION NORMAL

The most simple and easily corrected type of Class IV is that which is characterized by a **lingual malocclusion** of the **upper incisors,** the disto-mesial occlusion of the **buccal teeth** being about **normal.** For some reason not always apparent, the incisors erupt and occlude back of the lowers, frequently with no lingual inclination — the entire incisive process and alveolar ridge being involved in the local retrusion. One would think that it was caused by some early disease, which interfered with the development and forward growth of the incisive process, were it not for the fact that all other parts of the upper jaw and teeth are frequently found to be in normal relation and occlusion. This is well shown in Fig. 38.

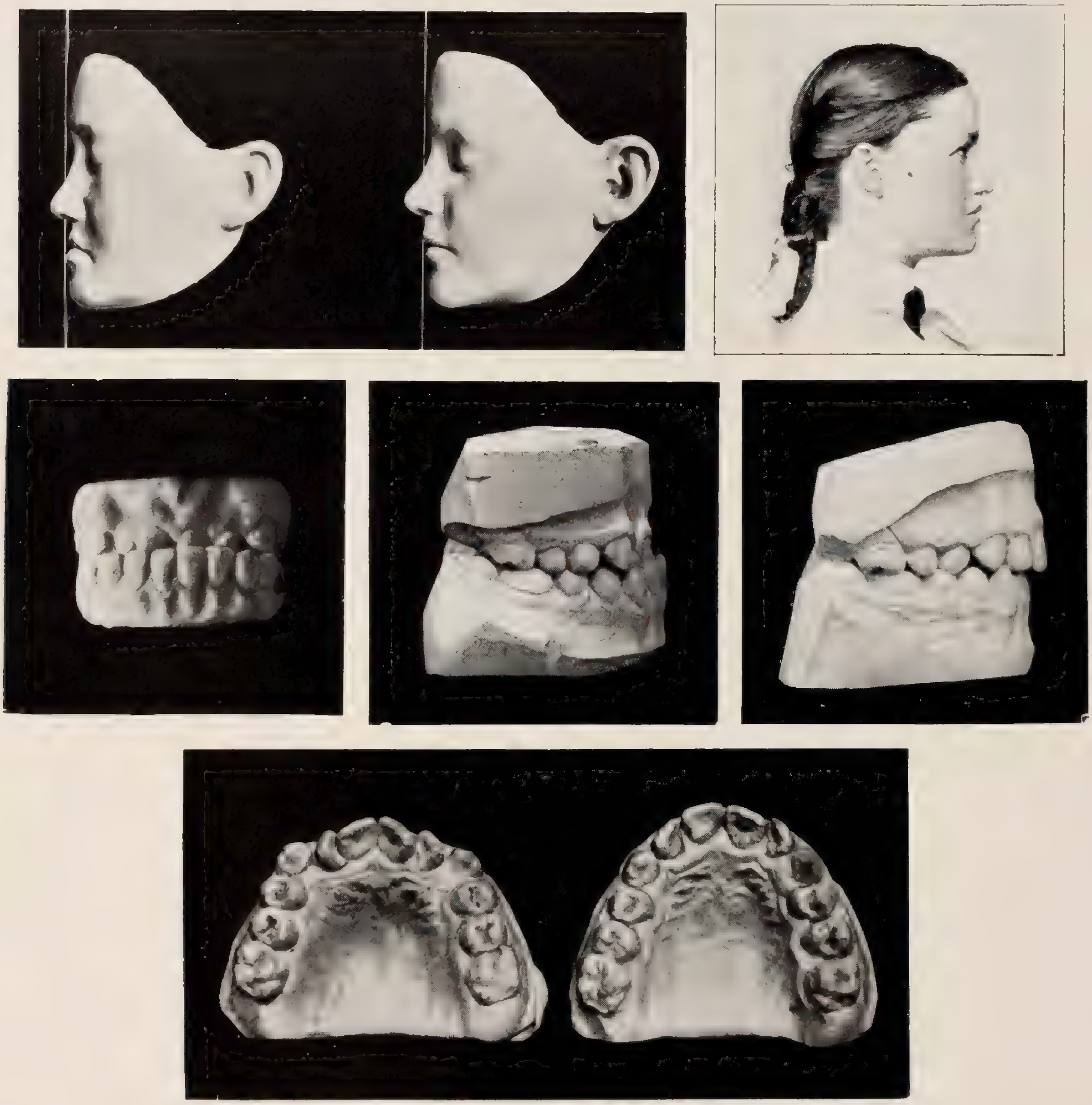
The photo-illustrations of the casts which are presented of the case chosen to illustrate this type are worthy of careful study, because they in themselves so undeniably refute every adverse criticism of the possibility and utility of bodily tooth movement. The character of the irregularity which is purely that of a **bodily retrusion** of the **incisor teeth** alone and the **entire incisive process,** will enable one to determine the exact corrective movements that were made by a comparison of immediate relations. First: Notice the normal dento-facial relation of the lower denture, determined by the esthetic relations of the lower lip to the chin, which is in perfect harmony with the principal features of the physiognomy. Second: the normal disto-mesial relations of the buccal teeth in occlusion, which even includes the upper cuspids. Third: the decided retruded position of the upper incisors, the roots of which are more retruded than the crowns. Fourth: the marked retrusion of the entire incisive alveolar ridge, and incisive portion of the superior maxillary bone, all of which is so plainly the cause of the retruded position of the upper dento-facial zones, bounded laterally by the deepened naso-labial lines, and below by the apparent prominence of the lower lip.

Compare the palatal and labial views of the dental casts which so perfectly show the changes which have been made in the alveolar arches, by moving the entire incisive ridge forward with the production of a more upright position of the incisor teeth than obtained at the start, and with a complete restoration of the facial outlines. This case has been chosen from many of a similar nature to typify this character of malocclusion, because it was one of the earliest of this class which the author treated, it having been regulated principally in 1893, since which time the teeth have perfectly retained their positions. The con-

touring apparatus which was employed in this case is shown in Fig. 39. It will be seen that the power bow differs somewhat from the present one in use.

On account of the retruded position of the incisors in relation to the prominent cuspids in cases of this type, it is not possible, or at least not advisable, to start the operation with the **Contouring Apparatus 87**. The incisor crowns should be first forced forward into alignment with some form of lingual or labial protruding appliances, so as to place them in a position to be firmly grasped by the power bow as explained in Type C.

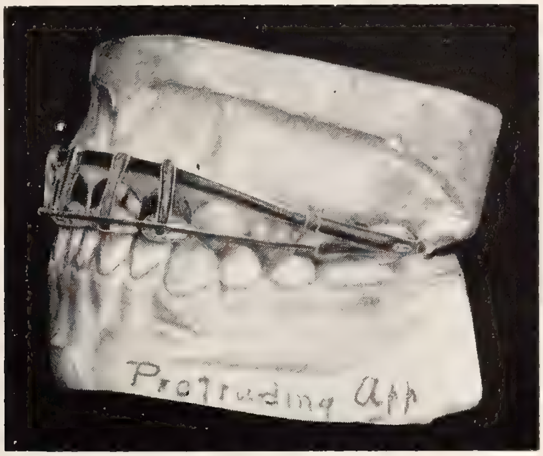
Fig. 38.



In every instance where an ordinary arch bow is employed for correcting the positions of incisors that are much retruded, the apical ends of the roots and the incisive process are never moved forward; with the result that when the case is

discharged the crowns of the teeth are in decided labial inclination, and the facial depression is far from corrected. Where such an inclination movement of the incisor teeth in these cases has been accomplished for patients not older than 12, and the incisal edges retained in that position, the developing influences of growth will perhaps in *some* cases *improve* the retruded position of the roots and alveolar process, but even that is always problematical; whereas, a bodily protruding movement of the roots of the upper incisors and the entire incisive

Fig. 39.



process with a perfect correction of facial contours *can be accomplished with ease and with perfect certainty* at any time between the ages of 10 and 18 years. At later ages the roots of the upper incisors can always be moved bodily forward, and if retained in that position the alveolar process will fill in around them, though the movement of the bone above, which supports the base and end of the nose, may not always respond to this protruding movement; in consequence of which the facial retrusion is not wholly corrected.

The reaction of the force required to protrude the roots of the incisors will frequently retrude the buccal anchorage teeth, though supported by the intermaxillary elastics. When this occurs with the buccal teeth originally in normal occlusion or nearly so, as in the present type, the occlusion may be corrected later by continuing the intermaxillary force with the retaining appliances. It will be noticed in all of these cases that the incisors have been brought forward to a perfectly normal inclination, while in the final facial casts the upper lips and entire upper apical zones, have been restored to normal contour, showing that something more than the alveolar process alone has been moved.

It is passing strange that men who essay to be teachers of Orthodontia, and who above all others should be interested in the advancement of the science, should seek as they do to disparage this very practical and exceedingly important principle of the bodily movement of teeth, when they have never tried it themselves, nor taken one step to investigate the truth of this work from the hands of others who have been continually practicing and publishing it for years.

CHAPTER XLIII

TYPE C. CLASS IV

CONTRACTION OF THE ENTIRE UPPER ARCH

Through a lack of normal development of the supramaxillary bones, due usually to pathologic conditions of the naso-maxillary sinuses, the entire **upper dental arch** will be **contracted** with high and narrow palatal dome. This forces the teeth into maleruption and malalignment, with a bodily retrusion of the incisor teeth and intermaxillary or incisive process.

Fig. 40.

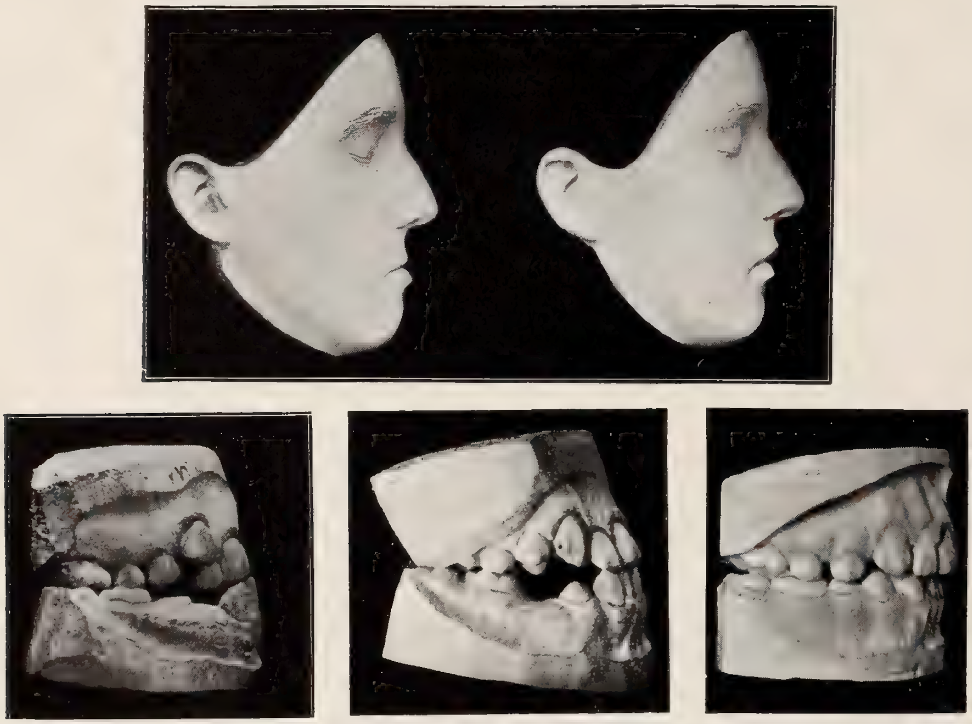


Fig. 40, which is that of a patient of about 13 years of age, will serve to illustrate this type. On account of the relatively prominent position of the cuspids it is often impossible, as mentioned in Type B, to properly attach the contouring apparatus at the beginning of the operation, it being necessary to first enlarge the arch and bring the cuspids into alignment. In this operation the buccal teeth should be united with stationary anchorages and with provisions for the inter-maxillary force so as to prevent their distal movement and thus cause the entire action to be directed to a forward movement of the incisor crowns, differing in this particular from the operations in Class I.

The middle dental cast of this case, which represents an intermediate stage of the operation, shows the common labial inclination which results from the ordinary methods of forcing the incisors forward any considerable distance. In other words, the crowns alone are moved forward, while the apical ends of the roots may really be tipped backward if moved at all. It has been claimed by those whose appliances were never calculated to move the roots of teeth, that root movement is unnecessary; that Nature will take care of that, if the crowns are moved. The final cast of the figure shows the corrected position of the incisors and incisive alveolar process immediately upon removal of the **contouring apparatus 87**. It will be seen that there were quite wide spaces between the buccal teeth at this stage and yet all the teeth are in an upright position. It will not be a difficult operation now to bring these teeth forward to an interdigitating occlusion with the **intermaxillary force**.

The cause which produces this type of upper retrusion, commonly occasions mouth breathing, which if long continued during the early years of development is the frequent cause of **open bite malocclusion**, with prognathic lower, characteristic of other types.

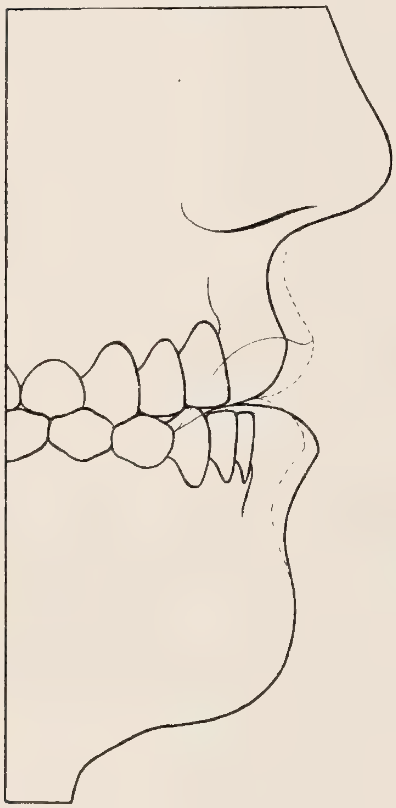
CHAPTER XLIV

Type D. Class IV

RETRUSION OF THE UPPER TEETH WITH PROTRUSION OF THE LOWER TEETH

In Type D of this class the **lower teeth are protruded** in relation to the **mandible,** which may be in **normal** pose; determined by the pose of the chin in relation to the unchangeable features of the physiognomy. The lower lip is therefore protruded in relation to the chin, and often with a complete obliteration of the labio-mental curve.

Fig. 41.



If the malrelation is slight in this type, the reciprocal action of the intermaxillary force properly applied will be sufficient to correct the condition for patients not older than 14 years.

The **protruding arch bow** should be attached to the upper labial teeth at or above the gingival margins, and the **intermaxillary hooks** for the elastics to the lower, should be attached to the distal ends of this bow, so that the force is exerted at first upon the labial teeth alone. If the roots of the upper incisors are markedly retruded with a depression of the upper lip, etc., provisions for a fulcrum bow as in **Ap. 87** should always be made, so that the force at any time may be directed wholly towards a bodily protruding movement of the roots. If the entire lower denture in a crowded arch are decidedly protruded in their dento-facial relations, shown by the protruded lower lip, as in Figs. 41 and 42, the **extraction of a bicuspid on each side** will be indicated; after which the retruding force of the intermaxillary elastics can be directed wholly to the lower labial teeth.

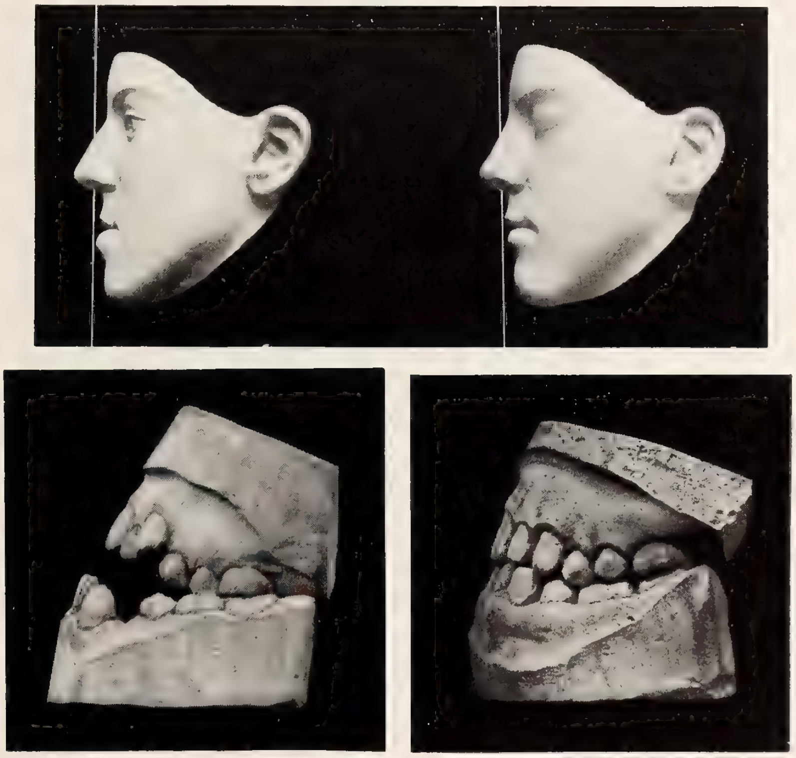
Fig. 42.

This type is well illustrated in Fig. 43, which represents a retruded and contracted upper arch due partly or wholly to diseases of the naso-maxillary sinuses, as in **Type C** of this class.

and a protruded lower arch which was treated as above by extracting the first lower bicuspids, followed by a retrusion of the lower teeth with the intermaxillary force, the reaction of which served to reinforce the upper anchorages.

To increase the difficulties in this case, an upper left lateral had been extracted by the local dentist to make room for a malerupting cuspid. The upper arch was so contracted in connection with an open bite malocclusion — which is common in these cases — that only the buccal cusps of the second molars occluded with the lingual cusps of the lowers, although the illustration makes it appear that the first molars also occluded. The dome of the arch was so high and narrow that it was frequently necessary to dislodge food from it with the fingers. To further complicate the case and enhance the facial deformity, the lower teeth were protruded in their dento-facial relations, as shown in the beginning profile cast, with an almost total obliteration of the graceful curve below the lower lip which serves to give esthetic prominence to the chin.

Fig. 43.



This was the first case of upper retrusion which the author had treated correctly. It was commenced in 1892, and described in a paper presented at the Chicago Dental Society, February 2, 1893, and again at the meeting of the International Dental Congress in August of that year. He has the honor to relate also that this case was the first published record of **two of the most important principles** of Orthopedic Dentistry, viz., the movement of the roots of teeth with the **Contouring Apparatus**, and the movement of the teeth of one jaw or both with the disto-mesial **Intermaxillary Force.**

In every contouring apparatus for the bodily protrusion of the labial teeth, in the author's practice, the intermaxillary force has always been considered an indispensable auxiliary to the apparatus, principally for reinforcing the anchorages and frequently for the final distal movement of the buccal teeth to close spaces and correct the occlusion.

In cases of open bite malocclusion in this class, the occipital force with the lower **occipital bow "B"** will be found a valuable auxiliary to be used as directed.

It is especially applicable in this type, as shown in Fig. 43, where the lower labial teeth demand a retruding and extruding movement to force them into normal incisal relations.

Fig. 44.

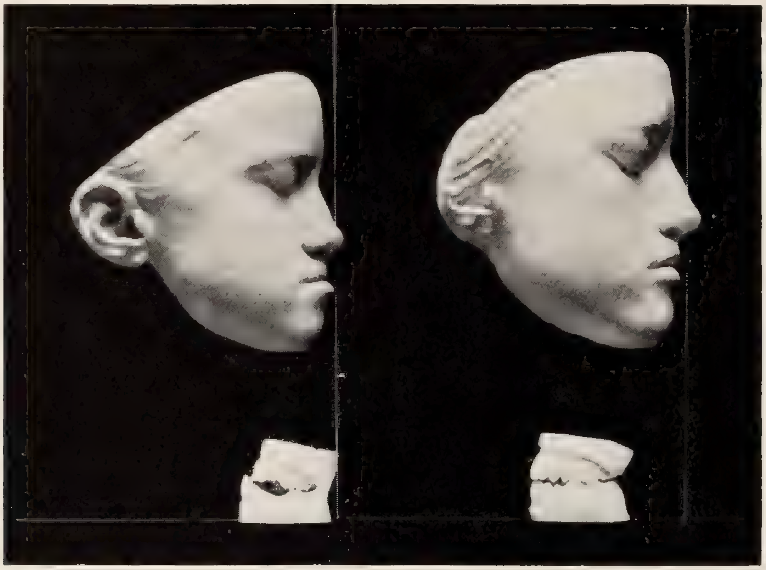


Fig. 44 represents another case of **Type D,** with the same protrusion of the lower dento-facial area in relation to the chin, in connection with an upper retrusion, but not with a contracted upper arch caused by diseases which produce mouth-breathing as in Fig. 43, and consequently with no open bite malocclusion.

The decided protrusion of the lower teeth in relation to the upper gave one the impression that the patient voluntarily forced the lower jaw forward. Dr. Charles Butler of Cleveland, who saw this case in its early stages, believed this to be a fact, until the patient voluntarily protruded the lower jaw still further forward in the usual manner.

When this case presented for treatment, the deciduous lower cuspids and molars had been removed, leaving only the full erupted permanent incisors and first molars. The sustained molar anchorages that were employed as an auxiliary in retruding the incisors, with the intermaxillary force in combination, presented an ingenious method for utilizing opportunities, the technics and prin-

ciples of which will be found fully described under "**Sustained Anchorages,**" in Chapter VII.

Fig. 45 was made from the casts of a woman 24 years of age, and represents one of the most pronounced and difficult cases of this type which the author has ever been called upon to treat. The lower buccal teeth on the right side were about the width of two bicuspids in front of a normal occlusion with the uppers; on the left side the difference was about the width of a cusp. This forced the lower incisors to the left of their normal position in relation to the uppers, as may be seen by the casts.

Fig. 45.

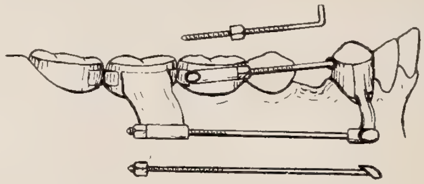
The greatest difficulty in correction arose from the decided protruded position of the roots of the lower cuspids — especially the right — with the production of quite a prominence of the overlying facial contour not noticeable in the illustration.

After the extraction of the first lower bicuspids, force was applied to the cuspids according to the only principle possible to move the roots. Any attempt to retrude these teeth with a single force applied even at the gingival borders would have tipped the roots still further forward. And yet one who has never tried, can appreciate the difficulties of moving the apical ends of the roots of cuspids, even with the most scientifically constructed apparatus, and especially for patients older than 20 years of age.

In this case, notwithstanding the fact that the anchorages were constructed in the most stationary manner, with every advantage taken to prevent inclination movement, the three molars in each anchorage moved appreciably forward, so

that it became necessary to extract also the second bicuspid on the right side, to fully reduce the protrusion over the cuspid. The first lower apparatus which was constructed, principally for the purpose of producing a bodily distal movement of the cuspids, is shown in Fig. 46, the principles of which have been repeatedly described in detail elsewhere. The lingual aspect, however, not shown in the drawing, would be quite like the buccal view.

Fig. 46.



The upper incisors were moved bodily forward in the usual manner with **Ap. 78**. During this process the cuspids and first bicuspid were forced to keep pace with this movement with push bars from the stationary anchorages, producing spaces for artificial second bicuspids.

Fig. 47.

The impressions for the facial and dental casts, Fig. 47, were taken upon the removal of the upper apparatus preparatory to making the retainer. The lower appliances being still upon the teeth, which were not fully regulated at the time of going to press, it was impossible to take more perfect impressions for this illustration. The impression for the occlusal cast on the left was made by pressing modeling compound against teeth while closed.

This case with the two shown under Figs. 49 and 50, were employed to illustrate a paper entitled "Importance of Moving the Roots of Teeth" read before the anniversary meeting of the First District Dental Society of New York, December 12, 1907. Learning that a number of Chicago's most prominent dentists were to attend this meeting as clinicians, and realizing that these cases illustrated a remarkable correction of facial outlines by an orthopedic movement of the teeth which had never before been accomplished to that extent, for patients at these ages, and which might reasonably be doubted, I invited all of these gentlemen to come to my office and meet the patient shown in Fig. 48, in order that they might be prepared to give evidence of the result in the discussion of my paper. These men were Dr. Truman W. Brophy, Dr. Hart J. Goslee, Dr. A. H. Peck, Dr. Marvin Smith, Dr. William V. B. Ames, Dr. J. Austin Dunn and Dr. Robert Good. A number of these men had seen the cases shown in Figs. 48 and 50, from the beginning of the operation, and the general opinions expressed by them at the meeting were that the illustrations presented by the lantern did not fully represent the improvement in facial outlines which I had obtained.

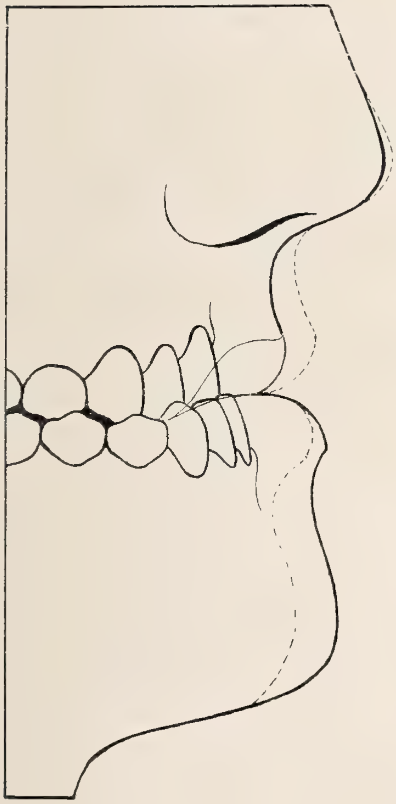
CHAPTER XLV

Type E. Class IV

UPPER RETRUSION WITH PROGNATHIC MANDIBLE

On the same principle that protrusions of the upper teeth will at times be complicated with a retruded mandible, **retrusions** of the **upper teeth,** as in the present type, will at times be complicated with a **protruded mandible.** Though the position of the lower teeth and lower lip may be found in every malrelation to a prognathic mandible, in the author's practice they are far oftener retruded in relation to the chin, and frequently with a lingual inclination of the labial teeth, as shown in the drawing Fig. 48. This would indicate that occlusion, and the retruding action of the labial muscles, had prevented the crowns of the lower teeth from being carried along with the forward growth of the mandible during the later developing stage of adolescence. In one case (Fig. 50), sufficient space was opened for an extra incisor, notwithstanding a decided lingual inclination of the labial teeth.

Fig. 48.

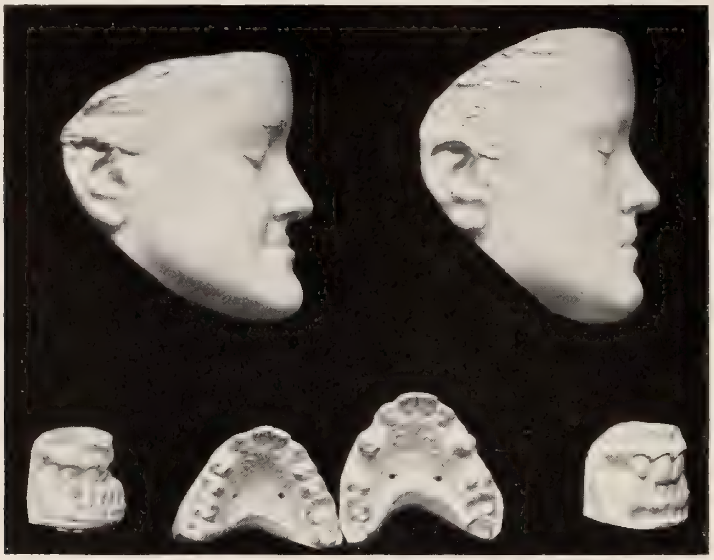


The present type, which refers to cases of this character, differs quite markedly in appearance and treatment from the pronounced characters of other types of this class.

Fig. 49 was made from the casts of a young woman about 18 years of age when the operation commenced. This case, like many others of this type, was undertaken purely with a view of correcting the facial deformity and for beautifying the facial outlines. The occlusion of the teeth was therefore considered of minor importance, providing that the facial result would leave the patient with a **good masticating denture** — perhaps partly artificial — that would sustain and retain the corrected positions of the labial teeth. It will be seen by examining the facial outlines of the beginning cast that notwithstanding the distal relation of the upper teeth to the lower, the dento-facial relations of the lower teeth are in a retruded position. If the lowers are fully corrected in their dento-facial relations, the protruding movement of the upper labial teeth would need to be pro-

portionately increased to place them in the proper occlusal relations. As this would demand an unprecedented bodily movement, it was decided to move only the upper labial teeth forward to a typical relation with lowers; which as shown by the illustrations proved to be more than satisfactory. The finished facial cast of this case goes to prove what I have said in other places, i. e., that a Gibson

Fig. 49.

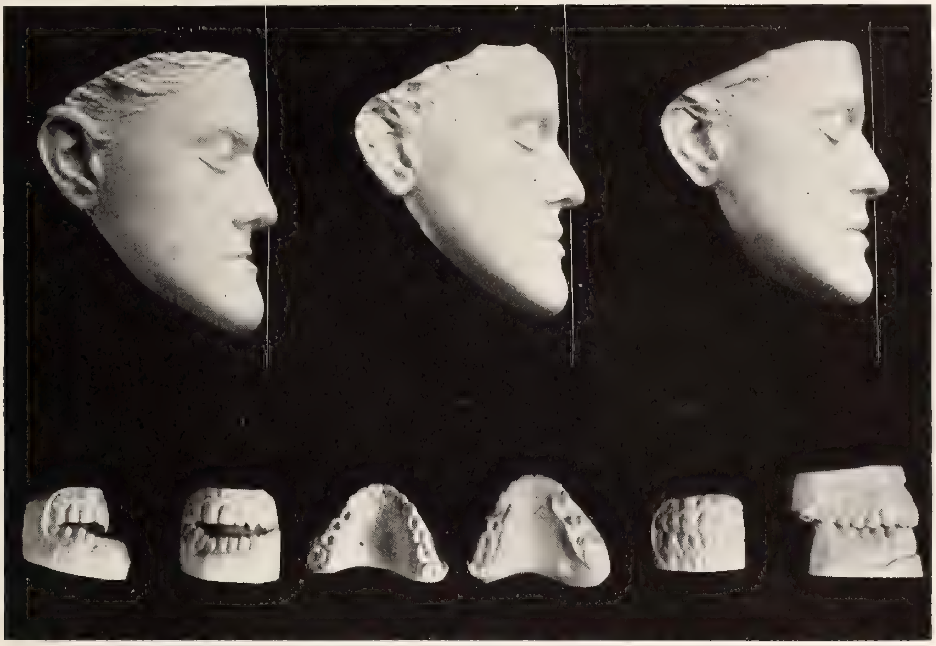


chin of quite pronounced prominence is not a deforming feature, providing the zones of the real dento-facial area are in harmony with each other and with the unchangeable features of the physiognomy. It will be seen by the finished casts of the upper teeth that the extensive protruding movement of the labial teeth and the distal movement of the anchor teeth left a space on each side of the first bicuspids sufficient for artificial bicuspids. The contouring anchorages were at first clasped to the two bicuspids and first molar, and were thus constructed in the most stationary manner and further reinforced by the intermaxillary elastics. The first bicuspids were afterwards moved forward to give greater stability to the artificial denture. To increase the difficulties, it will be seen also that the left permanent lateral is missing — that which is shown in the beginning model is a deciduous cuspid.

Another more pronounced character of this type, because of the greater prognathism of the mandible in connection with a decided open bite malocclusion, is shown in Fig. 50. It represents a Miss 18 years of age, for whom treatment was commenced January, 1905, at which time the beginning casts were made. The middle facial cast was made November, 1905, and shows the case in a partial but promising state of completion. The open bite malocclusion in this case was completely closed in a few months, partly by grinding the molars, but principally by the action of the occipital force, with the lower bow "B" engaging with a dental alignment bow attached to the lower teeth.

When the case presented she was wearing an artificial lower right extra lateral, attached to a slipper upon the cuspid — as may be seen by the beginning dental casts — the space having opened, probably during the abnormal growth of the mandible after the teeth had erupted. This was removed, of course, and notwithstanding the fact that the inclination of the adjoining teeth shows that the apical ends of the roots were very much wider apart than the crowns, they were perfectly drawn together so that they now stand in their proper parallel relations.

Fig. 50.



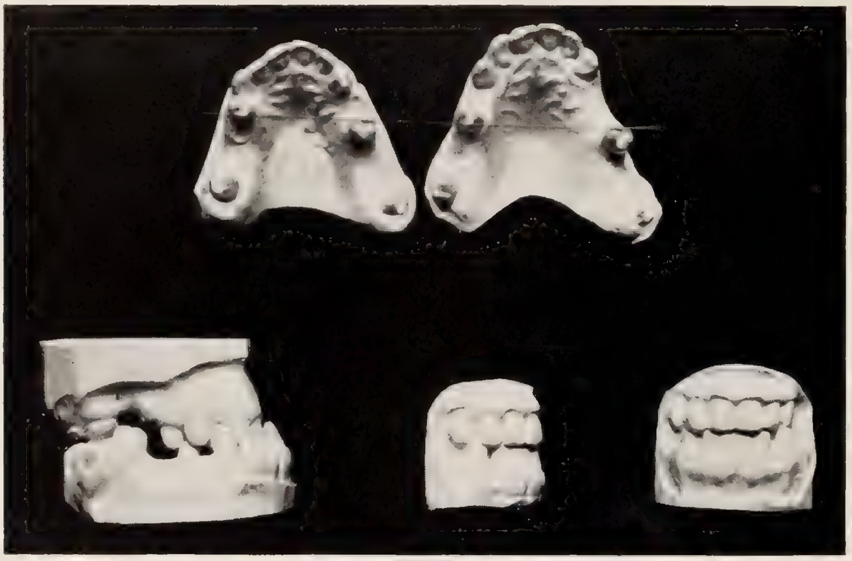
Attention is also called to the decided lingual inclination of the lower labial teeth at the beginning of the operation, as compared to the more upright position of the teeth in the final casts, showing how — after the lateral incisor space was closed, — the roots of the incisors were moved slightly backward and the incisal edges forward. It also goes to show the extensiveness of the upper movement, which accounts for the wide spaces in the finished cast for the insertion of two artificial teeth upon the left side and one upon the right. This unequal movement was produced to correct an unequal degree of retrusion upon the two sides and to harmonize the upper to an abnormal lateral bend of the mandible, which may have been caused during babyhood by lying mostly upon the left side. This particular feature of the correction, which brought the central interproximate spaces to the median line as shown by the finished occlusal cast, had much to do in beautifying the physiognomy when viewed from the front; as in the original state the position of the mandible in connection with the unequal retrusion of the upper dento-facial area gave it quite the appearance of a right lateral luxation.

The bridge dentures to complete the operation and support the upper dental arch were inserted by Dr. Hart J. Goslee, who saw the case in different stages of

its progress and will vouch for the perfect masticating occlusion of the teeth in the final result, and also to the correctness of the pictures here presented to illustrate the various orthopedic movements.

The author wishes also to say that the case being considered quite a remarkable bodily movement of the teeth, it was presented at two Chicago Dental Clinics, where many of the most prominent dentists of Chicago personally examined it and can vouch for the truthfulness of the casts and the movements of the teeth and alveolar process.

Fig. 51.



At the May, 1903, meeting of the Chicago Dental Society, the author presented several patients for whom he had accomplished extensive movements of the teeth at ages much older than it has been considered possible. To illustrate what may be accomplihsed in cases of this class for patients older than ordinarily attempted, Fig. 51 has been made from the dental casts of one of these patients. The operation was started at 38 years of age and finished in about one year and a half. At the time she was presented to the Society, at nearly the age of 40, attention was called to the upright and normal inclination of the upper incisors which are here shown by the final cast. Considering the age of the patient, the unusual distance of bodily movement of the incisors, the unstable character of the anchorages, and the beautifying improvement in the physiognomy for which alone the operation was undertaken, it proved to be quite a remarkable correction. The spaces were finally filled with a bridge denture constructed by Dr. Eugene Vigneron of Chicago, and up to the present time every movement has been retained. One of the pleasant features of this case was: the duties of her vocation, — that of a teacher of German in one of the High Schools of Chicago, — were uninterrupted during the operation, and her health and powers of vocal articulation were unimpaired.

CHAPTER XLVI

Classes V and VI

BIMAXILLARY PROTRUSIONS AND BIMAXILLARY RETRUSIONS

Bimaxillary protrusions and retrusions, as shown by the diagrammatical drawings below, when considered from a **facial aspect,** lie at the very extremes of dento-facial irregularities; but when considered from a **dental aspect,** the teeth will

Fig. 52.

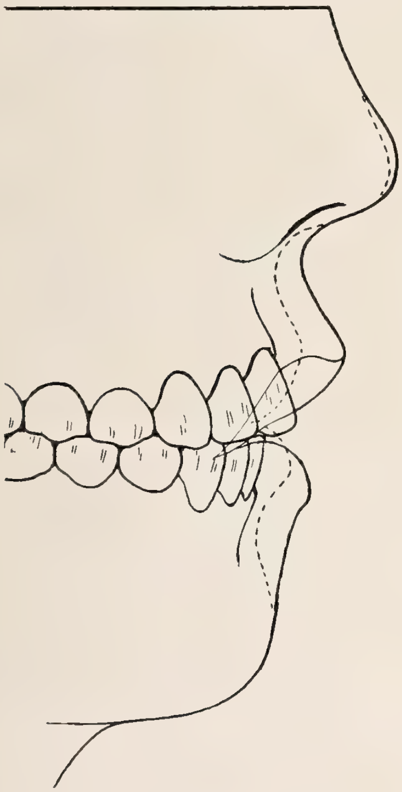
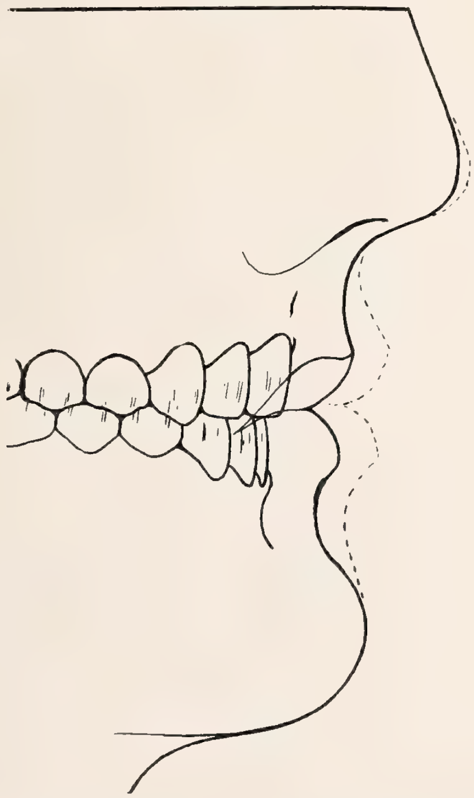


Fig. 53.

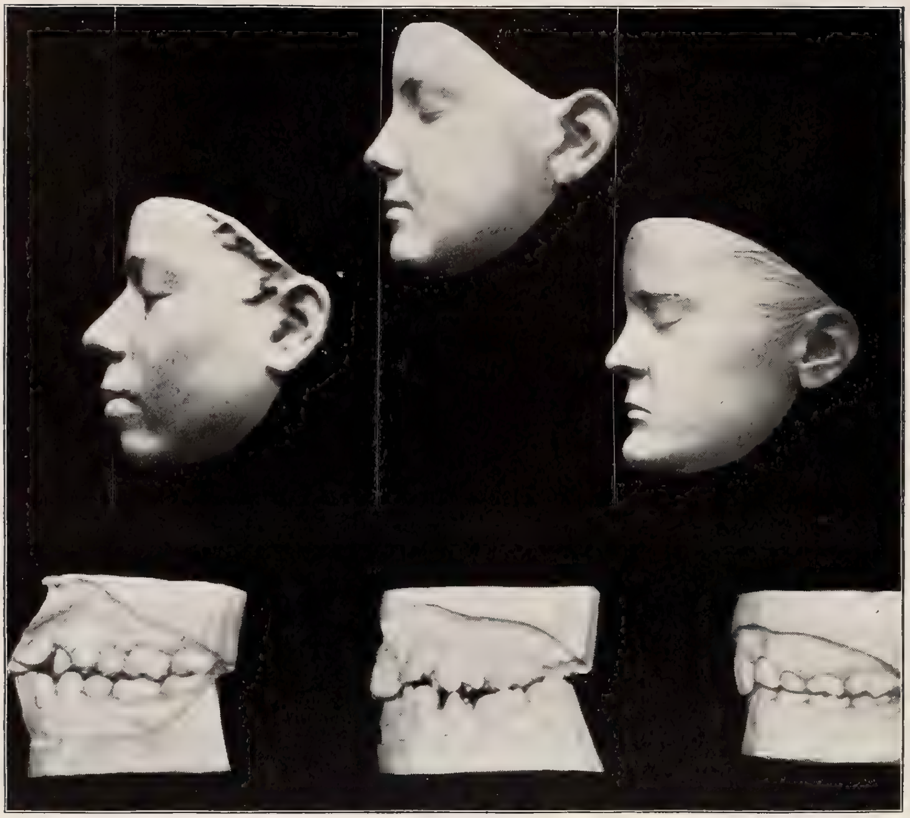


frequently be found in normal occlusion and alignment, the only marked difference being that the front teeth of Class V, Fig. 52, will usually be labially inclined and those of Class VI, Fig. 53, lingually inclined, though even this difference does not always obtain.

The composite of these two dento-facial malpositions of the teeth would be one in which the teeth and overlying facial contours are in perfect harmony with the physiognomy.

Fig. 54 will serve to illustrate the three characters. In connection with perfect facial outlines, as shown by the central cast, the teeth will frequently be

Fig. 54.



found quite irregular, with any of the simple or complex malpositions described in Part IV, but of course in fair antero-posterior relations.

Fig. 55.

The reader is referred to Figs. 23, 24, and 25, Chapter XII, for illustrations of Class V. The treatment demanded to correct the facial outlines in extensive typical cases of Class V is the **extraction of the four first bicuspids**—unless other teeth are missing or are badly decayed. The front teeth are retruded in the usual manner described in Class II. The principal, if not the only, retruding forces that should be employed in this class when the first bicuspids are extracted, is stationary dental anchorage force, although the occipital and intermaxillary force working in conjunction will often be found of great advantage in relieving the stress upon the anchorages and to finally adjust the occlusion. An interesting case of this class is fully described and illustrated with Figs. 48 and 49, Chapter XV.

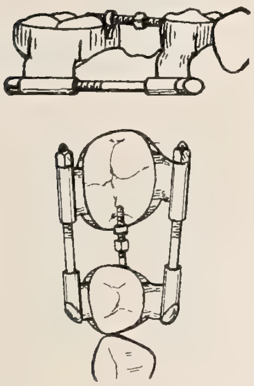
With Class VI, on the other hand, a protruding movement of the labial teeth and first bicuspids is indicated, with the insertion of artificial second bicuspids

to sustain the arches. A résumé of the clinical character and treatment of these classes, as compared to other malpositions, will be found in Chapters XII and XV.

Fig. 55 is a fair representation of a typical case of Class V, and had the cuspids erupted in alignment, the bimaxillary protrusion of the dento-facial area would have been intensified. This would also obtain were any attempt made at correction without extraction. It happened in this case that the four first molars were imperfectly developed during dentition, and at this time the crowns were extensively broken down with decay. These were extracted, and as the second molars were young teeth though fully developed — the patient being 16 years of age — they could not be expected to sustain a force more than sufficient to move the second bicuspids back much more than the width of the smaller tooth. Moreover, what is of the greatest importance after the extraction of first molars, is to avoid the mesial tipping of the second molars, which commonly occurs in nearly all cases when no artificial force is employed.

Fig. 56 shows the apparatus which is employed in these cases for the **bodily movement of buccal** teeth to close spaces, and which in this case was attached to the molars and second bicuspids. The upper drawing may be considered as both the buccal and lingual view as shown below. The traction bars upon the lingual aspect can usually be placed somewhat further rootwise than upon the buccal. The bands are No. 35 in thickness, wide and long bearing. These are placed upon the teeth in the usual manner and plaster impressions taken, which finally place the bands in their relative positions on investing plaster casts. To the bands are then soldered the rootwise extensions of No. 26 plate, to support long-bearing tubes, for No. 16 extra hard traction bars, as shown.

Fig. 56.



In addition to the advantages afforded by applying the force directly to the roots through the medium of the **rootwise bars** and rigidly constructed appliances, an independent **fulcrum bar** is attached at the extreme occlusal borders. In most cases a bodily movement of the roots of molar teeth would be impossible without the fulcrum bar, notwithstanding the fact that the power is applied as far upon the roots as the attachment of tissues will allow, which is hardly in accord with the claim that "a clamp band will move a molar bodily if it moves at all." See Principles of Bodily Movement, Chapters VI and VII.

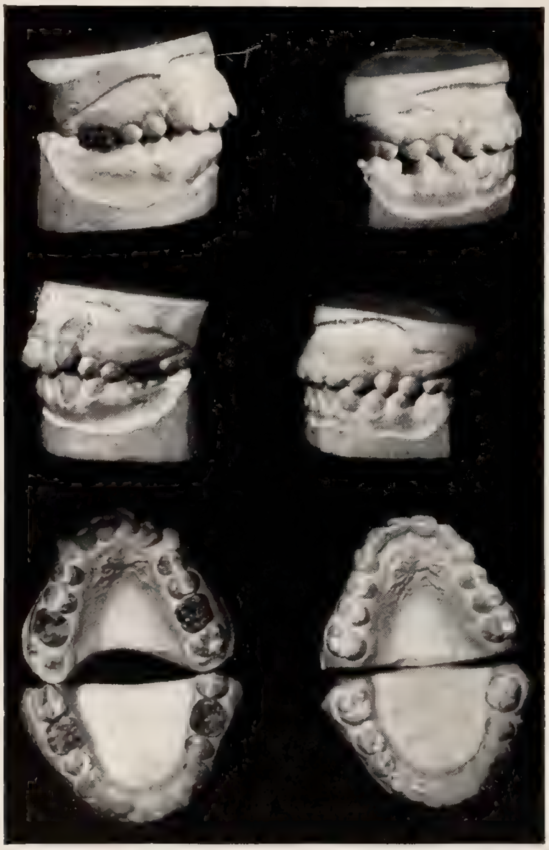
The **fulcrum bar,** No. 18 or 19, is soldered to the extreme occlusal border of the bicuspid band in a direction to lie along the sulcus of the molar. A very short section of a thin tube, supported by reinforcement, is soldered to the molar band in the proper position to receive the bar and serve as a reaction to a short or "lock" nut. The object of the short tube and nut is to avoid occupying the space needed when the teeth approach each other. When the occlusion of the teeth will not allow the fulcrum bar to lie upon the occlusal surface — which is quite rare — a

longer tube may be soldered lower upon the band to receive the end of a short bar, and then as the space is closed this is gradually cut off with a corundum or diamond disk. Occluso-buccal and lingual fulcrum bars may be also employed.

As long as the bands remain firmly attached to the teeth with this combination, the crowns cannot move toward each other any faster than is permitted by unscrewing the fulcrum nuts, while the main force may be directed in moving the teeth toward each other in a bodily upright position.

The distal movement of the bicuspids should usually be greater than the mesial movement of the molars. Only that amount of force should be employed that is required to create a resorption of the alveolar process in a disto-mesial pathway of movement, else extrusion of the teeth will follow, which must certainly be avoided.

Fig. 57.



In the case illustrated buccal tubes were soldered to the bicuspid bands — not shown in Fig. 56 — to sustain the ends of arch bows, which were principally for the purpose of carrying sliding tubes to communicate the auxiliary **occipital force** through the medium of **Bow C** to the upper second bicuspids. Buccal hooks were soldered to the second upper molar bands for intermaxillary elastics which engaged with **span hooks** at the lower cuspids, which in turn communicated this force through the medium of sliding tubes on the lower bow to the second lower bicuspids.

It will be seen that the retruding or distal forces of this auxiliary combination were equal in amount **only** to the applied occipital force. The latter should, therefore, be twice as great as the intermaxillary force in this case, to equalize the magnitude of both forces upon the distal appliances. The main object of the auxiliaries was to cause a movement of the first bicuspids and cuspids distally, which was accomplished with elastic ligatures attached to hooks upon these teeth and to the molar attachments.

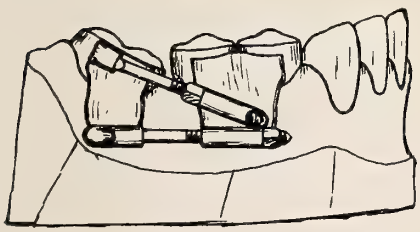
As this case is of great importance in its practical bearing upon the treatment of similar cases, I have removed the appliances before the operation is finished on the lower, to show the progress of movement up to the last moment allowed to present it in this work. This is shown in Fig. 57.

After the impressions for the beginning casts were taken, the first molars were then extracted and placed in the impressions before filling. Consequently they take the place of the plaster molars, as shown in the illustration.

It will be observed that the spaces of the upper first molars are now completely closed without the slightest distal inclination of the second molars. Also that the left lower molar is not inclined, though the space is not now fully closed; the bodily movement of lower molars being always far more difficult than that of upper molars.

It will be seen, however, that the right lower space is far from closed, and that the molar back of it is mesially inclined. This is due to the fact that during the summer vacation of the patient, the molar band loosened from its cement attachment, which he did not observe, and as he was supplied with wrenches to continue the work, when I next saw the case the molar was tipped forward far more than it is now. This required that it be forced back to an upright position to continue the bodily movements of both teeth. Fig. 58 shows the apparatus that was attached for this purpose, and which will be used to close the space.

Fig. 58.



CHAPTER XLVII

CLASS VII

OPEN BITE MALOCCLUSION

In the malocclusion which is characterized by an **open bite,** the front teeth are apart or open when the jaws are closed in an effort to masticate food. This character of malocclusion varies in its scope from conditions in which only the second

FIG. 59.

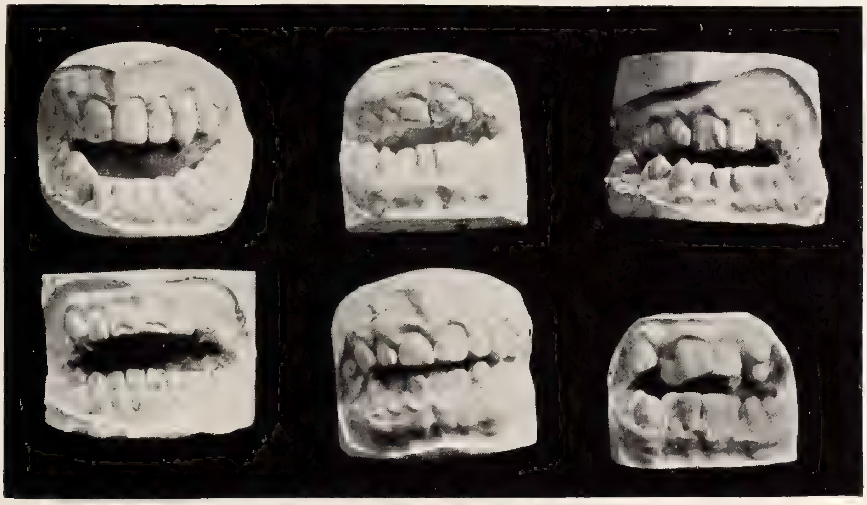
molars occlude, with the front teeth widely apart, to conditions in which all of the buccal teeth quite perfectly occlude, with the front teeth but slightly apart. In pronounced cases of this type, when the jaws are nearly or quite closed and the mouth in repose, the lips are usually quite widely apart, often with a drooping of the lower lip, which, even with patients of more than common intellectuality, produces the expression of imbecility. This is well shown in Fig. 59, which is like many other cases in the author's practice, many of whom at 14 years of age, were among the brightest in their schools. The conscious effort to close the lips in these cases will retract the muscles of the chin, and give the dento-facial area an awkward expression which enhances the deformity, as shown in Fig. 60.

FIG. 60.

The occluso-labial casts of a few typical characters of **open bite malocclusion** are shown in Fig. 61. The impressions for these were taken by pressing modeling compound against the teeth while the jaws were in masticating closure.

Occasionally the condition obtains far more upon one side than the other. Usually, however, the space between the upper and lower teeth quite uniformly increases from the point of occlusion towards the front, just as if the mandible had been bent downwards or straightened at the angles of the rami. In fact, in pronounced cases where two or more teeth on each side occlude, the back ones will at times seem to have been driven into their sockets through the force of mastication, or prevented from growing to their full height, so that the tuberosities come into close proximity to the angles of the rami when the jaws are closed.

Fig. 61.



The author has met with a number of cases, however, older than 25 years, for which the entire forces of mastication had been sustained by single molars on each side, with no apparent intrusion of these teeth.

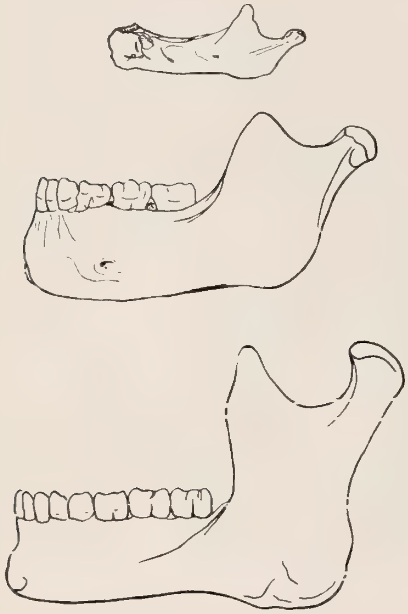
Causes

While there are doubtless certain isolated cases of open bite malocclusion caused from direct inheritance; from the inheritance of syphilitic taint; and even from thumb and tongue-sucking, etc., these are not the common **typical** characters of irregularity to which the author refers.

The principal, if not the only, cause of the typical form of open bite malocclusion, is **long continued mouth-breathing** during the early years of childhood development. The common local causes of early mouth-breathing are: enlarged tonsils, adenoid vegetation, or any of the diseases of the naso-pharyngeal passage which obstructs free breathing. The indulgence of mouth-breathing may arise from an acquired or inherited habit without discernible abnormal conditions of the nasal tract; and again with a partial stenosis that obstructs free breathing, yet one in which the mucous membrane is perfectly healthy. The habit quite commonly obtains with many people during sleep, who through a life-time of this indulgence, or necessity, do not experience any physical ill effects from it.

The probable production of open bite malocclusion from this habit is purely that of a mechanical action of the muscles in holding the mouth wide open to breathe more freely, principally during the involuntary activities of sleep. Its modus operandi is as follows: The mandible, with condyles resting in the glenoid fossæ as fulcrums, is pulled downward and held open by the hyoid muscles attached beneath the chin. Opposed to this force is the lifting action, principally of the masseter and internal pterygoid near the angles of the rami and body. These forces acting, upon an undeveloped mandible during the early years of its immaturity in form, will tend to straighten it, or more correctly speaking, will prevent the rami from fully assuming their natural approach to right angles with the body; thus causing the back teeth to occlude while the front teeth are more or less apart.*

Fig. 62.



To more fully illustrate this proposition, glance at Fig. 62, which was taken from Gray's Anatomy, and is intended to show the relative size and shape of the mandible at birth, puberty, and adult development, during which time the relation of the rami to the body changes from a decidedly obtuse to nearly a right angle.

From 4 to 12 years of age, when mouth-breathing from adenoid vegetations is quite common, the undeveloped quality of the bone renders it quite susceptible of being deflected from the form of its natural growth under the influence of slight continued abnormal pressure.

Fig. 63 is made from one of Dr. Cryer's illustrations of normal occlusion. In that shown on the right the mandibular portion of the picture was removed, cut at the angle, and replaced in the position it might assume during childhood, under slight continued force exerted in the direction of the arrows by the muscles while holding the jaws wide apart. In the discussion of a paper upon this subject by the author read before the American Institute of Dental Pedagogics, and published in the Dental Cosmos, December, 1905, Dr. Cryer accepted the above theory and its modus operandi as probably true.

Fig. 63.

* This theory of the cause of open bite malocclusion was first presented by the writer in a paper read before the Odontological Society of Chicago, and published in the Dental Review for July, 1894.

In many cases the relations of the rami and body may be seen from a profile view of the face to stand at a more obtuse angle than is normal, and with the frequent production of prognathism; both of which are well shown in Figs. 43 and 50, pp. 345 and 350.

If any one doubts that mouth-breathing is the cause of the common open bite malocclusion so frequently seen, I would ask him to inquire, in any case of typical open bite, if they do not, or did not, during childhood sleep with the mouth open. If the negative reply is received, in the author's opinion it will be because their attention has not been called to it before, or that they have long recovered from the cause and practice, and have forgotten.

While open bite malocclusion may occur in connection with any compatible malposition of the teeth,— for the same reason that children of every physical character may have conditions of the naso-pharyngeal tract which obstruct free breathing, — in the experience of the author it occurs far more frequently with that class of malocclusions which is characterized by a **retruded upper** and **protruded lower**.

When one considers the natural action of the causes which produce this character of open bite, this is readily accounted for. Any of the diseases which obstruct the normal development of the upper jaw, frequently result in a retrusion of the teeth. Again the concomitant mouth-breathing necessity which produces the open bite, by causing the angles of the body and rami to become more obtuse, increases the distance from the point of the chin to the condyles with a tendency to carry all of the lower teeth forward of their normal dento-facial relations.

If this forward movement of the mandible is sufficient to carry the points of the occluding cusps slightly forward of their normal interdigitation, the forces of mastication, acting upon the inclined facets, will tend towards a further protruding movement of the lower teeth, and a retrusion of the uppers.

If this explanation is true, it will at once be seen that any open bite malocclusion accompanied with a retruded upper and a protruded or prognathic lower, may be wholly or partially produced by any of the diseases which obstruct natural breathing through the nose during childhood, and upon any patient whose occlusion would have been otherwise normal. This also accounts for the probable fact that it occurs more frequently as a concomitant result in connection with malformations occasioned by interrupted development of the upper jaw.

Inasmuch as mouth-breathing during childhood may also occur in connection with any of the inherent dento-facial malformations and irregularities of the teeth, we find open bite malocclusions also occurring in every class of dento-facial irregularity; though if the malrelation due to mouth-breathing is pronounced, it is reasonable to suppose that the force of its action will have changed to that extent the inherent character of the irregularity.

In those cases of open bite malocclusion in which the antero-posterior relation of the upper and lower jaws and teeth are normal, the cause or causes which induced the mouth-breathing habit, were probably not of a nature to obstruct the

growth development of the maxilla. And while the natural distance from the condyles to the point of the chin may have been increased in the mandible, it was not sufficient to carry the lower teeth materially in front of a normal occlusion. Again, it may have been a case in which the natural occlusion of the lower buccal teeth was distal to normal in relation to the uppers.

As open bite malocclusion is seen to occur with only a comparatively few of the people who have indulged in the habit of mouth-breathing, the question will naturally arise: if this is the cause of the typical open bite, why is it not manifested in every case of mouth-breathing?

I can only answer this by saying that in holding the mouth open the muscles undoubtedly do not exert the requisite degree or quality of stress upon the mandible to obstruct its proper growth development. We certainly find that mouth-breathing without open bite malocclusion is quite prevalent from the aforesaid causes, in many cases of upper protrusions characterized by a high and narrow dome. And though these cases at times — without and even with an open bite malocclusion — appear as if the forward growth of the mandible had been obstructed, characterized by a receding chin as in certain forms of degeneracy, I still do not see that that vitiates the theory, viz.: that the principal, if not the only cause of the typical open bite malocclusion is due to the action of the muscles, as described, in holding the jaws widely apart during the developing stage of the mandible.

Treatment

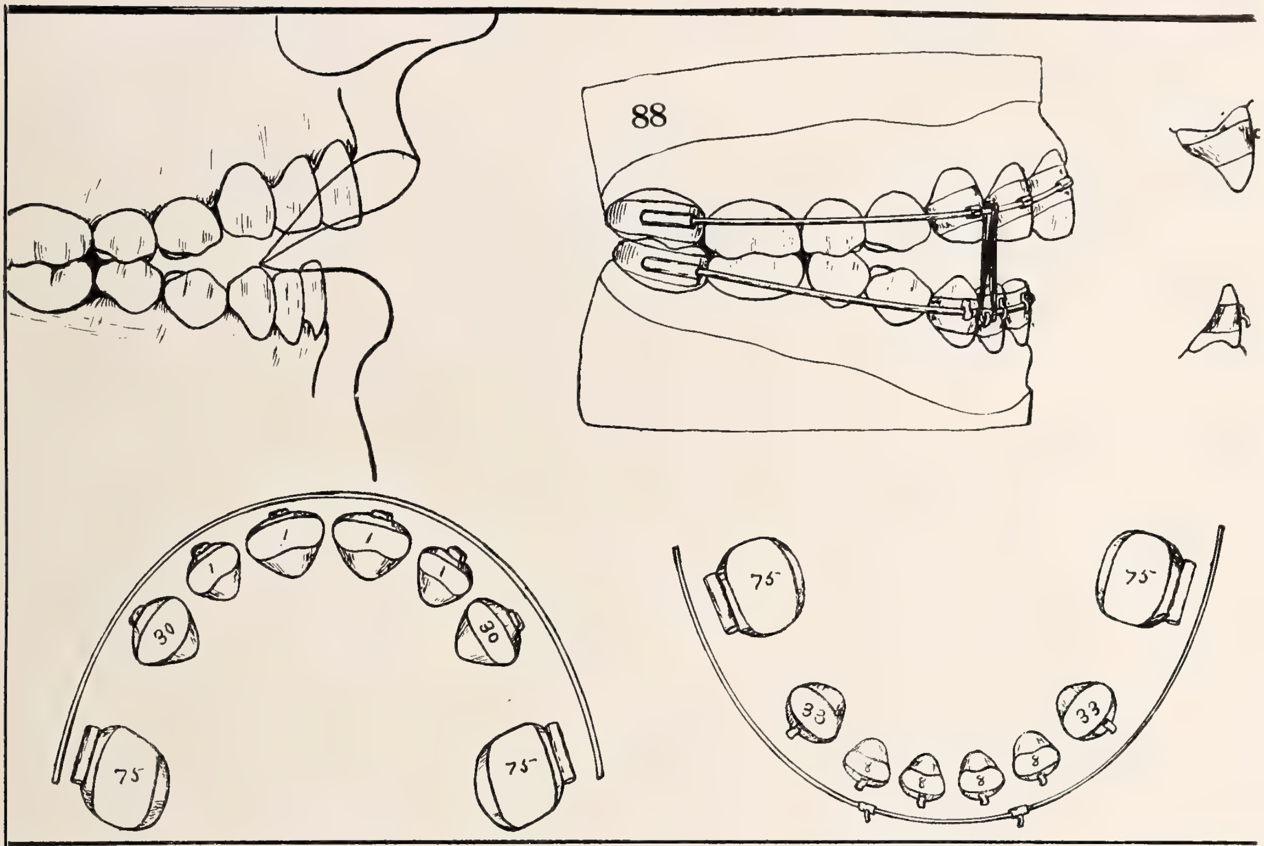
In the **treatment** of open bite malocclusion, it is the author's practice to correct the malocclusion partly by **grinding** the occluding buccal teeth, and partly by **extruding** the labial teeth. In other particulars, such as malalignments, protrusions, retrusions, disto-mesial malocclusions, etc., they are treated the same as in other cases.

I prefer to correct the open bite feature of the malocclusion more by a free grinding of the occluding surfaces of the buccal teeth, even to sacrificing the vitality of a molar on each side, than by extruding the labial teeth; because the latter movement is the most difficult of movements to retain. Moreover, the shortness of the lips in relation to the teeth, especially the upper, is frequently such as to preclude an extensive extrusion of the incisors.

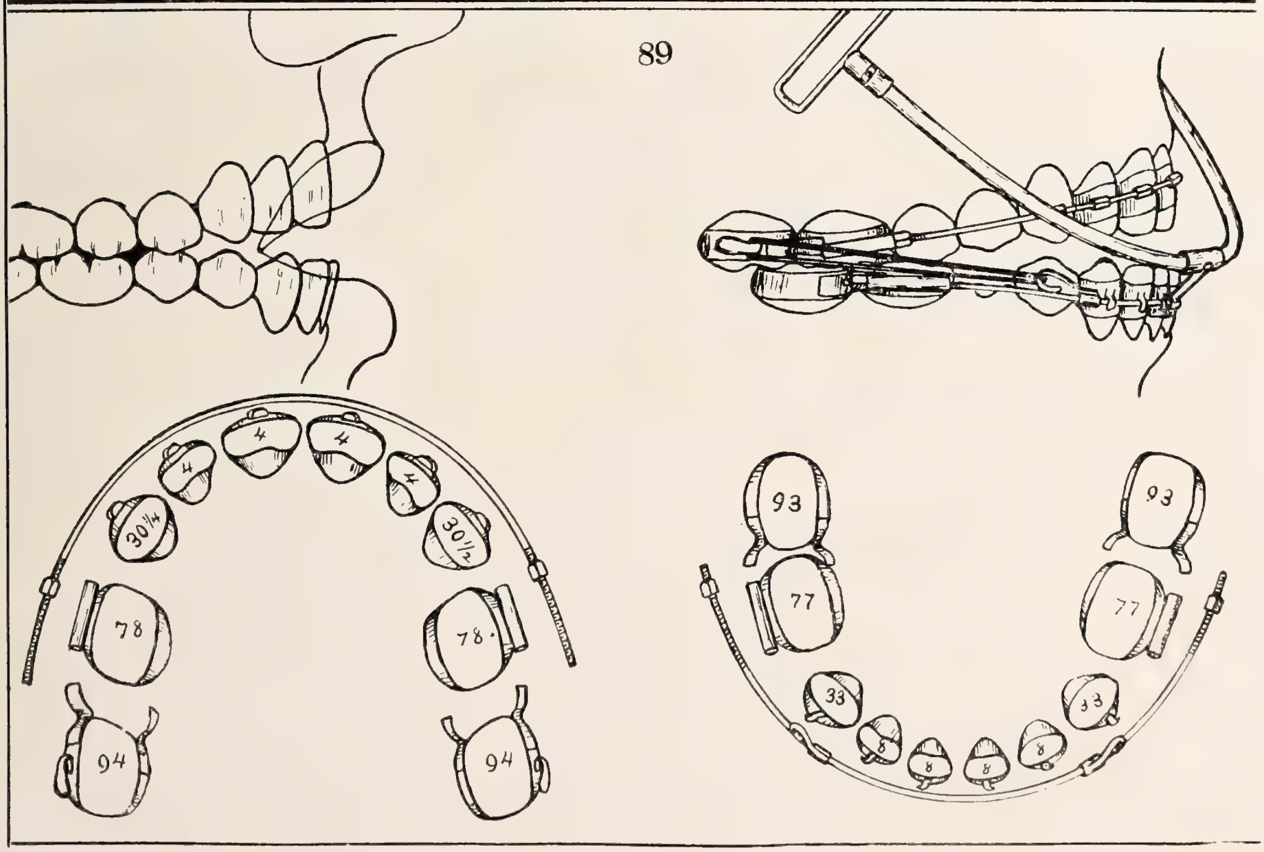
Apparatus 88.

When the malposition is not extensive, however, the labial teeth may be brought to their proper occluding plane principally by an extruding movement. In **Ap. 88,** arch bows No. 20, with ends resting in molar tubes, are attached to the malposed teeth with hooks or open-tube attachments. To the lower bow, **spur tubes** are attached with soft solder at the desired places, or spurs may be attached in like manner to both bows. From these, elastic rubber "election

88


1
1
1
1
30
30
75
75
75
75
33
33
8
8
8
8

89


4
4
4
4
30¼
30½
78
78
94
94
93
93
77
77
33
33
8
8
8
8

rings" are passed over the upper bow and back to the spurs, or the small elastic rings manufactured by Ash & Sons may be passed from the upper to the lower spurs. These are readily removed during eating and re-attached by the patient.

The principal difficulty in this class of irregularities is in retaining the positions of the mechanically extruded teeth, (1) because of the great tendency of the teeth to return to their former malposition, and (2) because of the difficulty in obtaining a retaining base of sufficient stability to combat the direction of the reacting forces towards intrusion.

If the bicuspids are not involved, a No. 19 or 20 resilient arch bow, with its ends resting in long tubes attached to the buccal teeth and passing over hooks on the labial teeth, will usually accomplish both the objects of extrusion and retrusion — the bow being sprung according to the demands. See **Ap. 5**, Group I. If nuts are not needed on the bow for protruding or retruding purposes, it may be slightly flattened its entire length by passing it through the rollers; then, by resting the ends in flattened buccal tubes, it will give a greater resiliency to the bow and less irritation to the lips.

One of the most satisfactory and effective methods in the author's practice for retaining the position of corrected cases, and one moreover which may be applied whenever the upper and lower labial teeth are in normal antero-posterior relations, either at the beginning of the operation or after partial correction and after the occluding surfaces have been ground as much as seems advisable, is that shown and described under Direct Intermaxillary Retention, p. 389.

The six-band retaining appliances will retain the teeth in alignment and relative stability, so that the intermaxillary forces are distributed to the entire phalanges of the labial teeth, to which they are attached. Should the bicuspids also demand an extruding movement, lingual bars (No. 18) may be soldered to the distal extremities of the appliances, to extend back to loosely fitting lingual tube attachments upon the molars. The said bicuspids are then banded with lingual hook-attachments to engage with the bars. It will be seen with this combination that any extruding movement of the labial teeth will also extrude the bicuspids.

In extensive open bite cases, all of the teeth except the molars may be involved, and occasionally only the first or second molars occlude. If the patient is very young and the mandible is protruding — as frequently obtains in these cases the **occipital apparatus** with chin piece, if worn persistently, may accomplish much good. If, however, the mandible is not prognathic, the direction of the occipital force will tend to retrude it and therefore should not be employed in these cases during the early years of adolescence.

Apparatus 89.

For the correction of **open bite protruding lower teeth,** the occipital apparatus with bow "B" as shown in **Ap. 89,** is one of the most effective methods

of retruding the lower teeth and at the same time extruding the labial teeth, to aid in closing the bite. During the hours that the occipital force is applied, which will tend to keep the jaws closed, the disto-mesial intermaxillary elastics may also be employed as an auxiliary. At other times, when the mouth is open, the intermaxillary force attached to the upper molar teeth will tend to extrude them, and increase the extent of the open bite malocclusion. The direct intermaxillary force, however, may be applied in these cases and worn at all hours.

It is to be understood also, that whatever the irregularity besides the open bite malocclusion, the apparatus is to be so constructed and the proper forces so applied that a concomitant correction may result.

Every one who contemplates the correction of open bite irregularities should fully understand that the difficulties and dissatisfaction that arise in the final retention of the corrected teeth, are quite in proportion to the extent of the desired extruding movement and the number of teeth involved. In extensive cases, therefore, much may be gained by freely grinding the occluding surfaces of the antagonizing teeth. If it were for no other reason than the improvement in masticating possibilities, no one should hesitate to devitalize the upper molars if necessary for this purpose, to aid in closing the bite and for its greater possibility of permanency of retention.

PART VI

Principles and Technics of Retention

RETENTION IN DENTAL ORTHOPEDIA

CHAPTER XLVIII

PRINCIPLES OF RETENTION

The art of moving teeth in the correction of irregularities has always been regarded as so nearly the whole of Orthodontia that the **retention** of corrected teeth has been largely considered a matter of course, and its importance, difficulties, and uncertainty of permanency have been lost sight of, or regarded thoughtlessly as a very minor branch of the art of regulating. It is possible and even probable that the art of retention will never approach so nearly to an exact science as that of regulating, because of certain natural influences over which one can have little or no control. Yet it is nevertheless a fact that the principal failure along this line has been and is largely due to inadequate teaching, which has been almost solely engaged in describing the various branches pertaining to the correction of irregularities up to the moment when the teeth are, or should be, retained. And where the importance of retention has been dwelt upon at considerable length, the means presented for its accomplishment, even by some of the most modern text-books, are so inadequate and crude, — to say nothing of the very probable injury to the enamel which might ensue from imperfectly attached bands and uncemented bars and rests worn upon the teeth any length of time, — that one is left to infer that a very few months of retention is sufficient, providing the teeth are brought to a normal or at least to an interdigitating occlusion.

It will have been observed by the careful reader, that throughout all portions of this work relating to specific methods of regulating, the author has repeatedly emphasized the importance, in all movements of the teeth, of keeping in mind the permanency of their retention.

Nearly all writers of note upon this subject, from Dr. Norman Kingsley to the present time, have emphasized the importance of moving the teeth to positions of symmetrically formed and related arches: always implying, when it was not more plainly stated, **proper occlusal relations** with the interdigitation of buccal cusps. In fact, that has always been the prime object of every one of even ordinary ability who has undertaken the correction of malposed teeth. But I am pleased to say that in recent years, largely through the teachings of Dr. Edward H. Angle in his efforts to establish the universal practice founded upon a typically normal occlusion, the importance of a properly interdigitating occlusion and the influence it exerts in retention will be more fully appreciated. It would seem that

any one of ordinary ability must know that when teeth are moved and left in a position where the masticating forces will drive them along the inclined planes of opposing cusps, that there can be only one result so far as that influence individually is concerned. But on the other hand, even when the cusps perfectly interdigitate, and even though a state of *normal* occlusion is established, if the teeth have been artificially moved to that position it is no positive evidence that the occlusion *per se* will retain even the buccal teeth: nor that this occlusion and retention will insure the retention of the regulated front teeth.

Failures of seemingly perfect operations have so frequently and persistently arisen because of the impermanency of retention, that it is not strange many dentists have abandoned attempts at regulating through lack of confidence in the utility of an operation which is fraught with so many difficulties and probabilities of ultimate failure. Nor is it strange that the operation is so commonly discredited among the laity. To be sure, at the present time, under the impetus of the so-called modern teaching, the dental profession is flooded with orthodontia enthusiasts and specialists who are attempting with confidence the correction of every irregularity that presents, however difficult. But like all theories and methods of whatever value that have come on the highest waves of enthusiasm, it is not unreasonable to expect that such orthodontia will also have its Waterloo, and be forced to go back to the development of the more honest resources of applied science and art which are destined ultimately to place this branch of dentistry far above the plane now commonly accepted as orthodontia.

In the earlier years of the author's practice, like many others who witnessed the failure of their best operations and realized the inadequacy of the retaining devices that were advised and employed, he also, would have been diverted from the practice of dental orthopedia had not means been invented to hold the teeth safely and acceptably for the extended periods demanded for permanency. This will be the experience of all who do not adopt scientific methods of retention, which will frequently demand appliances that require a high order of skill to construct.

Those who practice the character of dental orthopedia outlined in this work, and who fully grasp the underlying principles of retention, who appreciate its difficulties and advantages, and who are able and willing to devote to it that high order of mechanical skill which adequate retaining appliances demand, will find few things in dentistry that will bring quite the satisfaction and permanent pleasure as the branch they have chosen to practice. And even these men must be prepared to meet cases in which the forces of heredity will move the teeth back toward their former positions soon after the artificial restraint is removed, though perfectly retained a seemingly sufficient time.

The underlying principles of the art of retention may be divided as follows:—First: **Influences of Heredity.** Second: **Influences of Physical Relations** before and after correction. Third: **Principles of Retaining Appliances** and the **Technics** of **Construction** and **Application.**

Influences of Heredity

The inheritance of any family type of irregularity, from that of a single malturned incisor to extensive protrusions and retrusions, will be found difficult and in some instances impossible to retain in corrected position without a permanently attached fixture.

The longer I practice Orthodontia, the more respect I have for the general teachings enunciated twenty-five years ago and more, and published in that inestimable work entitled "Oral Deformities," by that most ingenious of all men of his day, Dr. Norman W. Kingsley. While the implements and appliances used for retention in those days were very crude as compared to those of the present time, the difficulties arising in certain conditions and the influences of natural laws remain the same, and continue to engage our most earnest endeavors, and often futile attempts at permanence of retention, even with the most perfectly constructed modern appliances. Dr. Kingsley expressed thousands of ideas that are as true and applicable to-day as when first written. Indeed, we continually see in print these and many time-worn important thoughts reclothed and represented in a new and forceful light, and I am sorry to say, too often introduced and claimed as discoveries of modern origin. He sums up in the following words all that need be said relative to the influences of inheritance:

"In hereditary cases of extensive character which have been delayed until at or near maturity, we can never feel certain that the original tendency to malposition so long unbroken will not reassert itself at any time that we abandon retaining fixtures."

Local Influences

The physical reacting forces, which tend to impair or destroy permanency of retention of regulated teeth, are by far the most prolific.

When teeth are moved from a natural or acquired position, the strong elastic and resilient fibers of the peridental membrane and surrounding alveolar process are strained, stretched, and bent, and unless these are held a sufficient time for Nature to rearrange the molecules to a new state of equilibrium, or supply the necessary elements for their fixation, they are sure to assert their power in forcing the teeth back toward the former malpositions.

Occlusal Influences

In regard to the influences of occlusion before and after regulation, I cannot do better than quote Dr. Kingsley at some length:

"The occlusion of the teeth is a most potent factor in determining the stability in a new position. If occlusion of the teeth will be such as to favor the retention of moved teeth in their new position, then considerable movement may

be attempted at almost any age at which it might be desired, and with an expectation of success; but if, on the other hand, the occlusion would be bad, with a tendency to drive them to their former positions, then all efforts at regulating would be folly at any age.

"Teeth could only be retained in changed positions under such circumstances by constantly wearing fixtures which would jeopardize their durability and permanence. The wearing of retaining plates as well as all other fixtures upon the teeth is undesirable and objectionable; they are an evil, necessary in some cases, but to be avoided as much as possible. Nevertheless, the fruits of a skillful and successful effort in regulating teeth must not be lost by neglecting to retain them in place until they not only become firm, but the tendency to return to their former positions has been seemingly overcome."

Dr. Edward H. Angle, in his work entitled "Malocclusion of the Teeth and Fractures of the Maxillæ," has also expressed many valuable thoughts relative to the principles of retention, which are worthy the careful study of all who essay the regulation of teeth. A small part of this teaching is as follows:

"It should ever be borne in mind that unless the conditions which have been operative in producing or maintaining malocclusion be removed or modified, the establishing of permanent normal occlusion can rarely be hoped for. For example, if the arches have been narrowed and the teeth forced to take malpositions as a result of mouth-breathing due to pathological conditions of the nasal passages, it will be very improbable that the teeth remain in correct occlusion after the removal of the retaining device, regardless of the time it may have been worn unless normal breathing be established, so that the mouth may be closed, and the teeth not deprived of occlusion and the normal restraint and support of the lips the requisite amount of time.

"Again, if irregularities of the upper teeth have followed as a result of the diminished size of the lower arch, from an overlapped or irregular condition of the lower teeth, it would be folly to expect the teeth of the upper arch to be permanently maintained in their new positions unless occlusion be established by harmonizing the proportionate sizes of the arches by correction of the positions of the lower teeth."

Importance of Interdigitation of Buccal Cusps

In the text matter of this work, and especially throughout Specific Methods of Regulating, in Parts IV and V, the careful reader has observed that one of the indispensable principles of regulation is to place the teeth in positions where ultimate self-fixation will not be obstructed by malocclusion. In the opening paragraphs of Chapter XII this feature of the subject is particularly dwelt upon.

While a normal occlusion of the teeth is eminently to be desired and striven for in regulation, if for no other reason than the aid it affords to retention, we should not forget that it is somewhat rare to find an anatomically normal occlusion

even among dentures which we would never think of regulating. But that which we do almost invariably find in all cases that are not open bite malocclusions, is that the masticating forces have caused the teeth to adjust themselves, so that the cusps of one set are fitted into the depressions and sulci of the other with considerable accuracy, showing that this relation, whether in a normal occlusion or not, must be attained, else Nature will attain it before she rests; nor can permanence of retention of the masticating teeth be assured before. In other words, a malocclusion with interdigitation of cusps is nearly, if not quite, as capable of fixing and retaining the relative positions of teeth as a normal occlusion. It is only in rare cases that we can hope to actually improve the masticating function of an acquired and fixed occlusion of even quite irregular teeth. For this reason an acquired or inherited mesio-distal malinterdigitation of buccal cusps with arches in normal width should never be disturbed except in those cases where one denture is protruded and the other is retruded; and even then there are many exceptions to this rule, as pointed out in Class III and elsewhere.

Importance of Extraction

There are many instances of irregularity for which esthetic relations cannot be perfectly attained without extraction; nor can that which it is possible at times to attain without extraction be retained with the same assurance of permanence because of the forceful tendencies of crowded buccal teeth to assume their former positions. I refer to excessive protrusion of the upper or lower teeth, with the teeth of the opposing jaw in normal dento-facial relations; also in full bimaxillary protrusions.

In the above cases, correction without extraction would mean that all of the teeth of the protruded arch or arches would require to be moved back fully the width of a bicuspid. While I will admit that it would be possible to move the buccal teeth of the upper jaw distally that distance, with a long-continued and heroic application of the occipital and intermaxillary forces for some patients not older than 12 years, the same amount of movement would not be possible with the lowers, because of the impossibility of applying the occipital force; nor, in bimaxillary protrusions, of applying to the lower a sufficient power from the combination of the occipital and intermaxillary forces. And in any event, with molars which had naturally erupted in that position — or, in other words, which had not drifted mesially because of the premature loss of deciduous teeth — such an extensive movement would in all probability produce a decided distal inclination of the crowns, with no perfect occlusion, thus robbing the operation of its principal, if not the only element of retention; while the tipped occlusal planes would constantly tend to force the teeth back to their former positions. Moreover, permanence of retention would still not be assured without the ultimate extraction of the third molars. And so after all, to satisfy a sentiment, this prolonged

and questionable operation resolves itself into the question, whether it is not better to extract a bicuspid on each side, followed by ease of correction and assurance of retention, than subject the patient and operator to far greater difficulties, with questionable possibilities of retention and the final extraction of the third molars.

Removal of Causes.— Narrow upper arches with high domes, protruded V-shaped labial curves with the buccal cusps occluding in the sulci of the lowers instead of on the buccal aspect, and the upper buccal teeth not lingually inclined, are not uncommon, and usually are caused by a lack of proper development of the maxillary bones due to early diseases of the maxillary and nasal sinuses, adenoid vegetations, degeneracy, etc. As Dr. Angle has pointed out, correction would be futile without a removal of the cause. There is another equally important requirement which pertains directly to retention, i. e., a bodily lateral expansion. See **Ap. 48,** p. 230.

Importance of Bodily Movement

If the molar teeth have been tipped mesially or distally in regulation or if linguo-buccal inclination of the crowns is produced, as would probably occur from an expanding jack as it is ordinarily applied, or through the action of an expansion arch bow to which the crowns of the teeth are attached with wire ligatures, the occlusal planes, especially of the molars, will subsequently be forced back to a more normal occlusal attitude. This has frequently been the main cause of a general failure of retention, and shows the importance of a bodily movement of buccal teeth. See Group V, p. 244.

I might also add to this theme, the teachings of those eminent writers and authors of text-books, Drs. Farrar, Guilford, Bogue, Goddard, Jackson, and others on this side and across the water, to further show that all men of large experience in orthodontia recognize and lay special stress upon the importance of the influences of inheritance and occlusion, in considering the permanent retention of regulated teeth. Beyond this I shall not attempt an outline of the various causes which operate to destroy the retention of moved teeth, nor describe in detail the imperfections and inadequacies of retaining plates and fixtures that have been and are still being employed.

Summary of Principles

The most important underlying principles which should be borne in mind are:

First: Teeth that are moved by orthopedic processes from one relative position to another are for a considerable time — often for years — subjected to the physical forces of surrounding tissues, which tend to move them back toward the irregular positions they formerly occupied.

Second: That these forces continue to operate until the stretched and bent fibrous structures are brought to equilibrium in their changed positions by the phys-

iologic processes of Nature. To most successfully aid Nature in the upbuilding of sustaining elements and structures, the moved and loosened teeth should be held relatively still during the entire period that is required for their permanent retention.

Third: A somewhat proportionate relation will be found to exist between the character of the forces required for movement and the reactive forces opposed to retention. In other words, if the movement will have required considerable force, the retaining fixtures will need to be of proportionate strength and stability, unless the teeth are brought to positions of positive self-fixation by occlusion. Again, the reaction will always be along the lines in the opposite direction to that of the movements — either rotation, inclination, bodily, or a compound of these three elementary movements — consequently the fixture should be so constructed and applied to completely overcome these reactive tendencies, the directions of which may be determined by comparing the beginning and final casts.

Fourth: As a rule, teeth that have been moved slightly are far more difficult to retain than those of extensive movements, because — as in ethical relations — ties of attachment that are slightly strained are far more liable to regain their former relations than if completely broken up. Adult patients frequently apply for treatment with no more than slight malturned lateral incisors, under the impression that successful correction can be easily and inexpensively accomplished; but these corrections more often than otherwise will demand a permanent fixture to retain them. In these cases the movement should be carried considerably beyond the required position in order to sever as much as possible the original attachments, and then be allowed to slowly return to nearly the required position, when the retainer is attached.

Fifth: Teeth that have been moved slowly will not require the same strength of artificial retention nor the same length of time as those that are moved rapidly, because Nature has had time to partially complete the upbuilding elements of retaining bone structure.

Sixth: While it is a fact that teeth regulated during youth are more easily retained than if regulated at maturity or later in life, no rule can be laid down as to the time retaining appliances should be worn proportionate to age, so varied are the conditions and influences that obtain with different patients. In nearly all cases where the teeth do not receive the positive self-retaining support of occlusion, the fixture should be worn at least two years. During this time it should be removed as often as there is any doubt of the slightest imperfection in its cement attachments to the teeth. At these times the teeth should be thoroughly cleaned, and slight malpositions which the loosened appliance has permitted, should be corrected with silk ligatures before recementing the appliance, which in the meantime has been cleansed and replated. Though a retainer may at times be worn from one to two years without removal, and without injury to the teeth, six months would be the limit, though seemingly perfect in its cement attachments.

Imperative Demands in Retaining Fixtures

To render the most aid in the upbuilding of tissues for the permanent retention of regulated teeth, the retaining fixture should be one that so firmly grasps the teeth that the several opposing forces are not only completely held at bay, but slight lateral movements occasioned by mastication, etc., are prevented.

Anything in the form of a retaining plate which requires frequent removals for cleansing is objectionable, and far inferior to a cement-attached appliance for holding the teeth firmly in the desired positions.

The fixture should be as perfectly fitted, finished, and cemented to the teeth as a bridge denture, and so constructed that the teeth and gums can be kept in a healthy condition, while it is worn with the same comfort and unconsciousness that a filling or artificial crown produces.

To fulfill these demands, its appearance in the mouth is of the utmost importance. Patients will submit to long, tedious, and painful operations; often with cumbersome and unsightly apparatus, stimulated by the hope of ultimate success, but when the teeth are finally brought to a satisfactory position they naturally object to a long and continued use of any form of appliance objectionably conspicuous or annoying.

One of the greatest objections to an attached fixture is the danger from decaying detritus lodged in the pockets of imperfectly cemented bands and uncemented extensions, which if allowed to remain will wreck the underlying enamel. To avoid this the best of retaining appliances should be carefully examined every two or three months, and patients also should be warned in regard to the danger of leaving the appliance upon the teeth after they discover that any one of the bands has become loosened and are in any way pocketing decaying foods or unhealthful secretions.

CHAPTER XLIX

LABIAL RETAINING FIXTURES

It will be observed, in the following description of **retaining appliances** for front teeth, that the author avoids as far as possible the employment of uncemented extensions or bars lying upon unbanded teeth. Though they may at times be used with safety, he prefers that retaining fixtures shall be composed of **united bands** which are perfectly fitted and cemented at all parts in contact with enamel. To say nothing of the danger to enamel of uncemented extensions, even when a single tooth has been corrected, the reactive forces — tending to carry it back — cannot be as perfectly and as quickly overcome as they would be with the tooth held absolutely still. Moreover, it is a somewhat rare occurrence, even with quite minor irregularities, that all of the front teeth are not moved more or less, demanding a proportionate retaining fixture.

As a rule, all fixtures — even those for the retention of a single tooth — demand at least two carefully fitted and cemented bands. When more than two teeth are involved in a labial fixture the end or **pier bands** are the only ones which need to completely encircle the teeth; and these may be quite narrow in front to be less conspicuous. For the same purpose the bands for the intervening teeth which are joined in the fixture are completely cut away, leaving only a small reinforced piece to lap on to the front, to insure a stable grasp of the tooth.

Quality and Thickness of Bands

The pier bands of the appliance, which are narrowed in front and usually cut to conform to the gingival border, are made of high-fusing **platinized gold.** Platinized gold coin, sold under the name of "B. & W." gold, is eminently fitted for this purpose. The cuspid bands in a six-band appliance, as in Fig. 8, are No. 36 in thickness. In a four-band appliance, attached to the incisors alone, (Fig. 7.) the pier bands are Nos. 37 or 38. For intervening bands, the fronts of which are nearly cut away, **German silver** is preferable, because of its greater strength and sufficiently high fusibility. These bands rarely need to be thicker than No. 1 o, which is about .0025 micrometer gauge. Small lateral and lower incisor bands may be even thinner than this.

Bands for retainers should always be as thin as the required strength will permit, in order to leave the smallest possible spaces at contact points while the appliance is in position. Also all portions of the fronts that are not absolutely required for stability of retention should be trimmed or cut completely away.

All exposed surfaces of the intervening German silver bands should be completely covered with gold in the soldering process. In an appliance involving four or more teeth, a **clasp metal plate** No. 28 is also soldered to the lingual surfaces of the bands, as will be described, to reinforce the stability of the fixture.

For extensions, use clasp metal D wire No. 19.

Technics of Construction

To illustrate the principles I have outlined, we will first consider a simple irregularity. See Fig. 1.

Fig. 1.

Fig. 2.

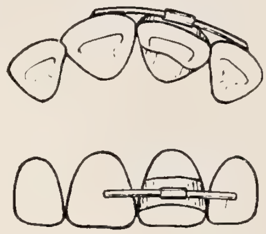


Fig. 3.

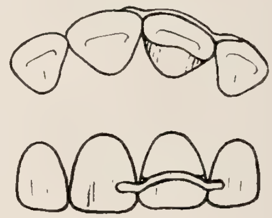
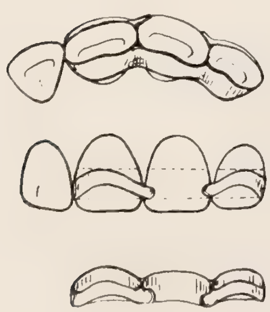


Fig. 2 is a common but very questionable retaining fixture, which consists of a bar passed through a rotating tube attachment, or soldered directly to the band. This fixture can be made less irritating to the lips and more inconspicuous and permanent by bending a D clasp metal wire to conform to the labial surfaces, and soldering it to a perfectly fitted B. & W. gold band, No. 38. The labial borders of the band are then trimmed nearly to the wire, and the whole perfectly finished and plated. See Fig. 3. The uncemented extensions which lie upon the adjoining teeth should be slightly convex on the under surface and perfectly finished, and the patient required to frequently clean them with floss silk.

Three-Band Retainer

As **uncemented extensions** are at best often dangerous to the enamel upon which they rest, for young and somewhat careless patients I prefer the appliance shown in Fig. 4. The outer pier bands are gold No. 38, with joint on the lingual aspect, and the intervening band, German silver No. 1/0, with joint on the labial.

Fig. 4.



I usually cut the pier bands somewhat after the pattern described on p. 381 for the cuspids, but of course according to the size of the teeth. See Fig. 10. The bands are perfectly fitted and burnished to the inequalities of the lingual surfaces, and a partial impression is taken, using only sufficient plaster to submerge the bands. The bands are then carefully removed from the teeth with the **removing pliers,** and accurately placed in their respective positions in the impression, and their inner surfaces luted with a thin solution of plumbago. Care should be taken to prevent the luting from pene-

trating between the proximate surfaces of the bands as it would stop the flow of solder. The plumbago may also be flowed over the plaster for the purpose of separating.

The impression is now filled with investing plaster and the cast, with the bands in place, is trimmed to a minimum size of stability for soldering. A small appliance of this character will usually require no lingual re-enforcement plate.

In the soldering process, commence on the **lingual side** with high grade gold solder, which should unite the bands and flow over the lingual surfaces to stiffen them. The cast is then turned and small pieces of platinized gold are placed over the contact points to serve as a nucleus for the flow of solder to form the small labial laps or T extensions The labial face of the intervening German silver band is cut away in finishing, leaving only the labio-proximal extensions. All thickened interproximal portions immediately rootwise from the contact points should be ultimately removed.

The important feature in this character of an appliance lies in the fact that every part in contact with enamel is perfectly fitted and securely cemented, thereby insuring stability of position and immunity from harm so long as the cement attachments remain perfect.

Four-Band Retainer

Fig. 5.

Fig. 6.

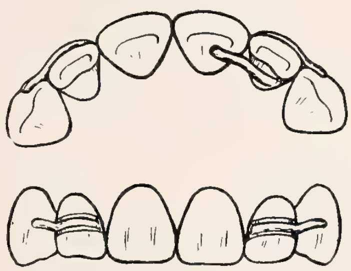
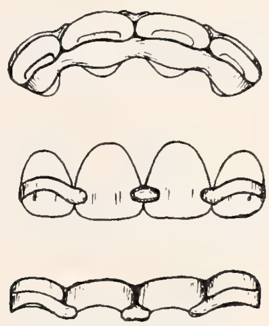


Fig. 7.



In Fig. 5 both laterals are malturned.

Fig. 6 shows an improvement over the bar attachment that is commonly recommended. In construction it is similar to Fig. 3.

Fig. 7 shows the appliance which is far preferable. It is constructed similar to Fig. 4. It will be found equally applicable where all of the incisors are malturned but in alignment with cuspids that are properly posed.

Six-Band Labial Retainer

In a large proportion of irregularities, all of the labial teeth are more or less malposed or require to be moved to bring about a proper arch alignment and occlusal relation; therefore the most common retaining appliance is that which includes the **six front teeth.**

Fig. 8, which includes the cuspids, is very similar in construction to the appliance last described. This was first published in the Ohio Dental Journal, January, 1898 (See Fig. 9), and represents the standard retaining appliance which the author has successfully used in his practice for hundreds of cases during the last ten years.

Fig. 8.

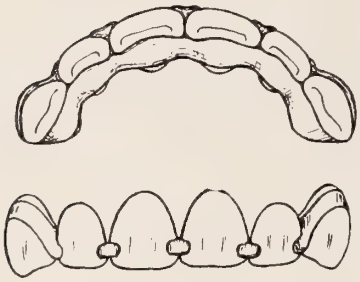
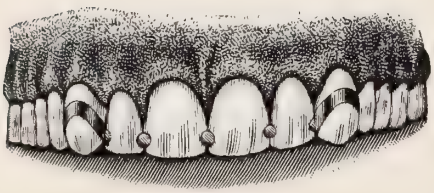


Fig. 9.



It has been found that by holding the labial teeth firmly in their relations to each other they rarely move in phalanx, even after the correction of quite decided protrusions or retrusions. Again, after the correction of narrow V-shaped arches, by preventing the labial teeth from reacting, the bicuspids and even the molars rarely move, though not otherwise sustained. In cases of decided protrusions and retrusions, however, and particularly when the incisors have been moved bodily in phalanx, provision is always made for lingual bars to the molars to overcome the tendency toward reaction. Supplementary attachments to the labial retainers will be found fully described in Chapter L.

Unless the labial retainer can be constructed with the same skill required for crown or bridge dentures it had better not be attempted, because it will fall short of its desired object, and may easily result in a thing which cannot even be placed on the teeth; or one which, if attached, will not hold the teeth firmly; or will in itself, force them to irregular positions.

Long experience in its use has taught the importance of certain exact requirements in its construction which, if followed, will result in an appliance that will fulfill every demand and one, moreover, which the most fastidious patient will not object to wearing the required time.

Details of Constructing the Six-Band Labial Retainer

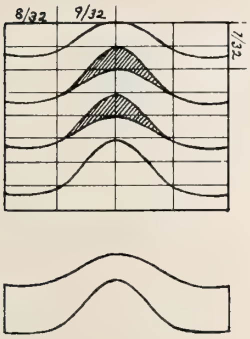
When the teeth are regulated, or moved slightly beyond their correct positions, no force should be exerted through the medium of the regulating apparatus for a week or two except that which may be accomplished with light silk ligatures to hold the teeth or true them up.

As it is always desirable to place the retainer the same day that the apparatus is removed, an early appointment is made in order to have plenty of time; though in an expert handling of the work, two and sometimes three of these appliances can be made and placed in one day. When a six-band retaining appliance is first placed it is not cemented, but allowed to remain about one week upon the teeth that they may become adjusted to it and facilitate a quick placing required by the setting cement.

When the regulating apparatus is removed, the teeth are cleaned preparatory to taking the measurements and fitting the bands, as described. At this time it will frequently be found that the teeth are not quite in the exact positions they appeared to be in before the apparatus was removed, or they may have sprung slightly out of place after its removal. This is especially true of malturned teeth which have not been carried **beyond** their normal positions — as they should be. In this event a skillful tying and management of Corticelli A silk ligatures will usually correct the positions during the time the bands are being soldered preparatory to fitting. Occasionally they will require a second tying and at times it will be well to postpone fitting the bands until the next day to obtain the required positions.

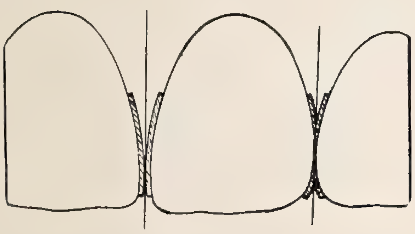
In order that the cuspid bands — which are the only ones in the six-band retainer which encircle the teeth when finished, — shall be as inconspicuous as possible, they are cut from a pattern (Fig. 10) which provides for a wide lingual portion with joint, and a narrow labial portion, which conforms to the gingival line. When properly soldered, fitted, and contoured, this pattern will be found to perfectly fit every cuspid.

Fig. 10.



In preparing to construct the cuspid bands, a piece of No. 36 B. & W. gold, one and one-sixteenth of an inch wide, is annealed and marked as shown by the straight lines in Fig. 10. A little practice will enable one with a delicate pair of curved manicure scissors to cut the band according to the pattern shown in the lower part of the figure. The thickness of this band, No. 36 (.005), with that of the adjoining one, No. 1/0 (.0025), will produce about as much space between the cuspid and lateral as would be caused by two layers of common writing paper; and this can be reduced at the contact point, if desired, with a paper disk, as shown in Fig. 11.

Fig. 11.



The incisor bands should never be thicker than No. 40, and preferably No. 1/0, German silver. Alternate bands — as for instance the right lateral and left central — should be sufficiently wide to extend beneath the interproximate gingivæ. The extra width insures the interproximate portions of alternate bands serving as **entering wedges** in the first placing of the appliance after it is soldered. This will be more fully appreciated in the later description and especially in practice.

Preparatory to fitting them on the teeth the labio-gingival borders of the incisor bands, as shown in Fig. 12, may be trimmed down to narrow ribbons of sufficient strength to hold them intact during construction. The occlusal borders should be trimmed free from the incisal edges, being sure that the **contact points** of the teeth are well covered. It is next to impossible to fit a thin wide band that requires forcing on and off the teeth several times without proper tools. The hard

wood plugger and band removing pliers (Figs. 58 and 59, p. 46) will be found invaluable in this operation.

When the bands are placed, an impression is taken in **investing plaster** and treated as has been described. (Fig. 13.) In separating the cast from the impression in this instance, the **lingual portion** of the impression is saved, as shown

Fig. 12.

Fig. 13.

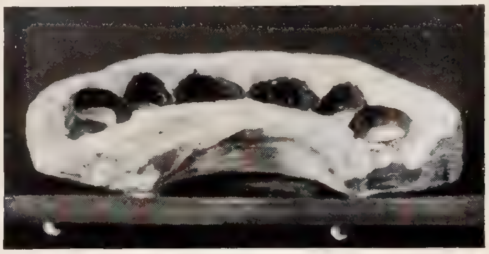


Fig. 14.

in Fig. 14, from which to obtain the **die** for swaging the lingual reinforcement plate, which is made of No. 28 Clasp Metal. This is well shown in Figs. 15 and 16, swaged, trimmed, and placed in position to solder. It will be seen that it is cut a little narrower than the lingual surfaces of the bands to facilitate placing and drawing the gold solder beneath, which should finally be flowed over its entire surface. It is of the utmost importance to stiffen, in this way, the six-band labial retainer to prevent the reacting forces from changing the new curve of the arch, especially in all cases where the arch has been laterally expanded.

Fig. 15.

Fig. 16.

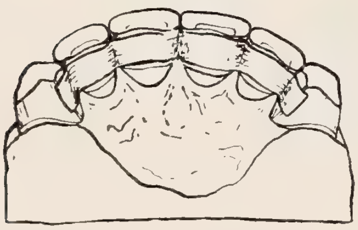


Fig. 17.

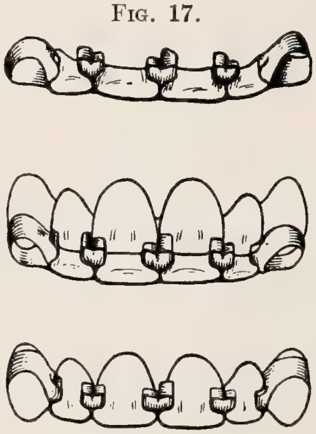


Fig. 17 shows the appliance unfinished in different positions with the proximal guide extensions for the temporary placing. To prevent the solder from producing thickened portions in the interproximal spaces above the contact point, the bands should be pressed closely together at the stage shown in Fig. 13, before filling the impression. Another **important move** at this time is to burnish the gingivo-lingual edge of the band firmly against and slightly into the plaster impression, as it is liable to contract in the soldering and thus prevent the appliance from going fully to place.

Placing the Appliance

The general flare of the labial teeth often occasions considerable difficulty and pain in placing the appliance when finished. This has been one of the greatest drawbacks to its general adoption, though much has been due to the lack of perfect accuracy and care in its construction.

The difficulty in forcing a six-band appliance to place for the first time makes it usually necessary to place it **temporarily,** to remain about a week to allow the teeth to become adjusted to it, so that the final placing can be made with the rapidity required by the setting cement.

Moreover, the temporary placing will rarely be possible if started at the cuspids. It should be started at the **median space**; then the laterals, and finally, the cuspids. When it is forced to a starting position upon all of the teeth, it can then be easily malleted to place with the **wood plugger** and finally with a narrow, unserrated foot plugger to drive home the interproximate portions.

To facilitate starting the appliance at the median space, etc., in the preliminary fitting of the bands, the interproximal rootwise extensions of alternate bands act as **entering wedges** in the first placing. With this object in view, very wide banding material should be selected for the incisor bands, every alternate band of which may be narrow, or trimmed narrow, on its proximal border, so that only one thickness will intervene to form the starting wedge; and finally, all thickened portions rootwise from the contact points — occasioned by the solder flowing in between the bands — should be filed thin. As will be explained, all temporary extensions of the bands that are used to aid the first placing are removed at the final placing of the appliance.

Though it may seem to be impossible at times to place, or even start, a six-band appliance of this character on the teeth, on account of the disto-mesial flare at the occlusal zone, yet it would not be surprising to the author if that same appliance might be readily placed by the hands of an expert, or even after a little experience. However, when it is, or seems to be absolutely impossible to place the appliance, as sometimes occurs, there is no objection to sawing it in two through the lingual section of one of the centrals, which will enable a temporary placing of the appliance for a few days, then an impression is taken, etc., as was described for the bands, and the sawed surfaces are soldered.

After the appliance has been worn for about a week to aid the final placing, it should be removed and finished for the permanent placing. All proximal portions and extensive labial lappings of the incisor bands are cut down to the contact point extensions. The labial T extensions which will have been covered and thickened with gold should be allowed to lap upon the teeth sufficiently to hold them firmly in grasp: especially upon teeth that have been rotated, and at points where the greatest reactive force will be exerted. After the appliance has been worn for a few months the extent of the laps may often be safely reduced, so that no more appears than is often seen with proximal gold fillings. See Fig. 9.

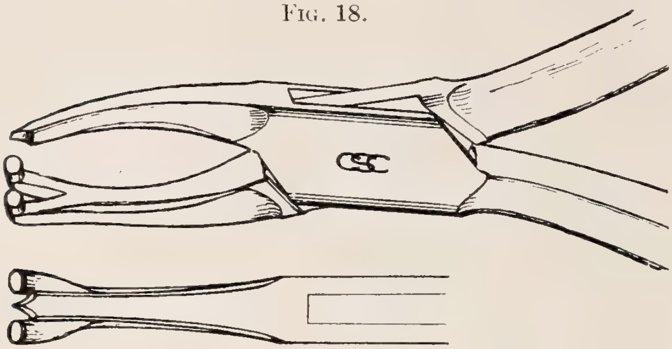
Removal of the Appliance

It is *imperative* that a retaining appliance be removed *immediately* upon the discovery that any portion of it has become loosened from its cement attachments

to the teeth, because these loosened places serve as pockets for the retention of decaying detritus which soon attacks and destroys the integrity of the enamel.

The need of removing a retaining appliance intact for the purpose of reattaching it, which is necessarily very frail at its interproximal T extensions, and which is usually firmly cemented and attached at nearly all points, cannot well be accomplished without proper pliers; to say nothing of the pain that would be produced by a free hand attempt to lift or pull it from its attachments to the teeth. This is especially true of the six-band labial retainer. In many instances the pliers shown in Fig. 59, p. 46, will answer the purpose, but the one which is especially adapted for this part of the operation is that shown in Fig. 18.

Fig. 18.



Restoring the Broken T Extensions

It occasionally happens with the most careful handling that one or more of the proximal extensions will be torn off. Any attempt to repair it by soldering the broken edges together would be futile, because of its exceeding thinness at this point, which should not be thickened with a reinforcing piece or overflow of solder. It can, however, be very easily and perfectly restored in the following manner: — Cut the appliance nearly in two with a thin saw, by commencing at the occlusal border and following the proximal line marked by the broken edge. Now place the appliance in position on the teeth, and form a new T extension by fitting and burnishing to the place a piece of narrow No. 1/0 banding material which has been bent to the form of a T, as shown in Fig. 19. An impression is then taken in plaster and the appliance removed with the T, and carefully placed in the impression. When this is filled with investing plaster, the cast when removed holds the T in place ready for soldering. The solder should be flowed between all surfaces which lie in contact. Finally, with a small piece of platinized gold lying upon the top of the T, form with the solder the labial face of the new proximal extension. This when finished will be quite as strong and perfect as the original piece.

Fig. 19.

CHAPTER L

SUPPLEMENTARY RETAINING ATTACHMENTS AND APPLIANCES

In the correction of nearly all **Simple and Complex Irregularities** found in Part IV, and also many types in **Classified Irregularities** in Part V, if the **six-band labial retainer** described in Chapter XLIX is properly constructed and attached, it will be commonly found sufficient in itself to perfectly retain the teeth, even though the buccal teeth which may have been considerably moved are not involved in the grasp of the fixture. This of course presupposes that the upper and lower teeth have been brought to the desired relative positions, and that the cusps of the buccal teeth perfectly interdigitate, though perhaps not in a typically normal occlusion.

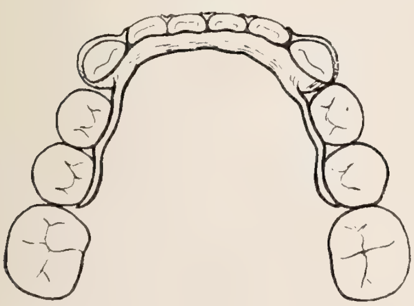
There are, however, a number of important supplements to this appliance which will be demanded for the retention of extensive movements.

Retention of Lateral Expansions

If one arch has been laterally expanded to the desired occlusion with a normal opposing arch which has not been moved, the simple **six-band labial fixture** will usually retain the expansion and any changed curve or malalignment of the labial arch. But if the operation has been performed without due regard to the forces of occlusion and the opposing arch has been allowed to remain laterally contracted, the stability of these unmoved teeth will surely drive the expanded teeth back to their former positions. This force of occlusion will frequently be sufficient to bend or displace any labial retainer that is not of unusual proportions, and will finally complete the failure of the operation after the retainer is removed.

When both arches have been laterally expanded, as they should be in the last-named condition, if the lower expansion is supported with a **clasp metal bow** Nos. 16 or 14 soldered to the lingual face of the six-band labial retainer, as shown in Fig. 20, the forces of occlusion in connection with the regular upper labial retainer shown in Fig. 8, will usually be sufficient to hold both arches in position.

Fig. 20.



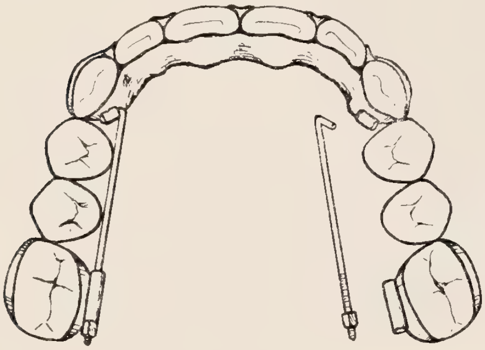
With certain occlusions it may be found expedient to attach the **lingual bow** to the upper instead of the lower, and in some instances to both arches. The length of the arms and size of the wire for the lingual bow will be governed by the demands of the

case. If the distal area has been much expanded, with a demand that the arms extend to the molars, they should be supported by thin lingual tubes soldered to No. 36 gold molar bands, and with every precaution in finish for cleanliness and non-irritability.

Retention of Retruded Movements

When all of the upper or lower labial teeth have been retruded to reduce decided protrusions and close spaces occasioned by the extraction of bicuspids, the **labial retainer** should carry thin No. 19 tubes soldered to the linguo-distal borders of the cuspid bands, as shown in Fig. 21, for the purpose of attaching the appliance to the molars, either at the start or upon the first indication of a return movement. The **traction bars** are Nos. 19 or 20 German silver, and usually should be provided with mesial and distal nuts to firmly lock them in the lingual tubes attached to gold molar bands.

Fig. 21.



This will enable one to keep all interproximate spaces closed, and if at this time the occlusion is perfected it will be found sufficient. In many cases in which the age of the patient and position of the teeth, etc., favor permanency of retention, the **lingual bars** and **molar bands** are not at first attached, though the lingual cuspid tubes in these cases should always be placed in the construction, to be employed if found necessary. The tubes being small, lying close to the gum and properly finished, give no irritation or annoyance.

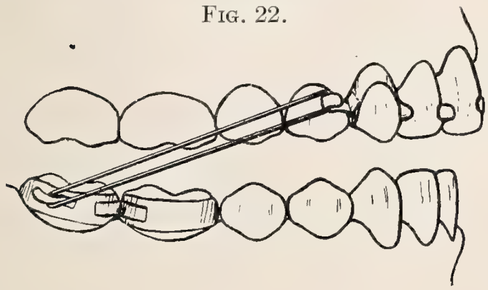
Intermaxillary Retention

In cases which are purely protrusions of the upper to the extent that the buccal cusps interdigitate fully the width of a bicuspid in front of a normal occlusion (such cases being usually corrected by the extraction of the first or second bicuspids), the buccal teeth may be forced slightly forward of an interdigitating occlusion if employed as the sole anchorage force for retruding the labial teeth, and if employed as the sole means of retention, will tend to be dragged further forward by the reacting force of the front teeth. Or it may be one of the many cases which in its original state the upper teeth in relation to the lower teeth were protruded,—perhaps to the extent of the full width of a bicuspid,—but which according to dento-facial relations was found to be due partially or wholly to a retrusion of the lower denture, and consequently corrected without extraction.

In both of these events, **labio-distal hooks** should be soldered to the labial retaining appliance as shown in Fig. 22 for the purpose of continuing the **intermaxillary force**.

The hooks are No. 28 clasp metal soldered to the labio-distal surface of the cuspid bands and formed to protect the bicuspids from the action of the elastic.

Fig. 22.



In all cases where the intermaxillary force has been extensively employed for the disto-mesial correction of malocclusion, nothing but a continuation of this character of force, in a milder degree, seems capable of retaining the position gained, notwithstanding the fact that the teeth at times have been brought to perfect or normal interdigitating occlusion. Moreover, where the final movements for the disto-mesial correction of malocclusion can be accomplished with the intermaxillary force alone, the labial retainer may be attached for this purpose as soon as the six front teeth are corrected in relation to each other. This is a most important proposition, and one which all orthodontists will take advantage of in those cases where it is indicated, as soon as they understand and appreciate the value of a properly constructed **labial retainer,** because it permits the early removal of unsightly regulating apparatus. It is of special importance where one or the other arch is decidedly retruded, and the opposing arch is but slightly — if at all — protruded, as the locking of the labial teeth together in phalanx in this way increases their stability opposed to movement, as in stationary anchorages.

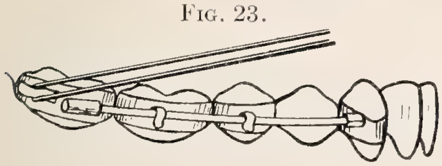
Intermaxillary Anchorage Methods for Retention

In determining the character of the opposing anchorage appliances for applying the intermaxillary force, warning cannot be too often repeated in regard to the care that should be exercised in the application of a mesial force through this medium, as the same rules here obtain as in major movements. These are in the main:

First, when no mesial or extruding movement of the buccal teeth is desired, the anchorage hooks for the elastics should be placed at the most distal points possible, and attached to a two or three band stationary anchorage. See Fig. 22.

Second, if a mesial force or movement is desired and the extruding tendency of the elastics is feared, the intermaxillary hooks should be attached to the most distal points of single molar bands, — preferably to the second molars, — which are anchored down with Nos. 19 or 18 bars, the distal ends of which rest in short tubes upon the anchor molars, and pass forward under hooks or through short open-tube attachments on the first molars and the bicuspids to **rests** upon the cuspids. See Fig. 23. All of the these bands should be as thin as the desired strength will permit. With this combination, the extruding force will be distributed to all the

Fig. 23.

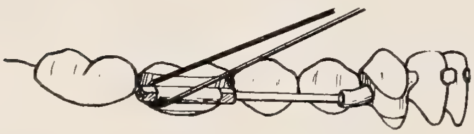


buccal teeth while a mesial tipping of the crowns will be permitted through the possibility of the contact points sliding upon each other. If an arch bow is employed instead of the bars, the incisors may also be attached to it if desired.

Third, if the extruding force or movement is desired, following the correction of an open bite malocclusion with **Ap. 85 or 86,** the elastics should be attached to single **first molar bands,** or to the **crowns** which were employed to open the bite, and the balance of the apparatus arranged to distribute the force to the bicuspids, similar to **Ap. 85.**

Co-operating with a Lower Labial Retainer.— In a large proportion of cases, the lower dental arch and malaligned or malturned incisors have been corrected, demanding the employment of the six-band labial retainer. In these instances it is frequently desirable to directly connect the retainer to the intermaxillary anchorages, which enables an even distribution of the protruding force to the front teeth and a complete relief upon the bicuspid area, so that these teeth will not be crowded out of line by contact pressure. This is one of the common methods employed by the author in the mesial action of the **intermaxillary force** upon the lower or upper arch, when the front teeth are in alignment. See Fig. 24. To the labio-distal surfaces of the cuspid bands of the retainer are soldered **flattened tubes** which are bent to receive the mesial ends of Nos. 18 or 19 bars, the distal ends of which are locked, with mesial and distal nuts, in buccal tubes upon the first molar bands or opening crowns. When the intermaxillary elastics are looped over the distal nuts or attached to special hooks, the force may be distributed directly to the labial teeth in phalanx. The bars may also be employed to correct or retain the bicuspids.

Fig. 24.



Reciprocal Retaining Action of Intermaxillary Force

The most common malocclusion for which the **intermaxillary retainer** is especially applicable is that of Class III, in which the upper buccal teeth are the width of a cusp in front of a normal occlusion and corrected without extracting.

If the forward movement of the lower teeth has not been sufficient to produce an abnormal labial inclination of the front teeth or to force them out of alignment, the intermaxillary buccal anchorages for elastics to the upper labial fixture, as in Fig. 22, will usually be found sufficient to retain the occlusion; though when a forward movement of the lower is desired, the methods shown in Figs. 23 or 24 will be indicated.

Where the lower teeth have been moved forward considerably with the intermaxillary force, it is presumed that the incisors have usually been kept in an upright position in bodily movement, with the Contouring Apparatus 84. Upon removal of the regulating appliances, the **contour retaining apparatus** (Fig. 29, described later) should be attached to the lower, in connection with the **intermax-**

illary labial retainer upon the upper. It perhaps is needless to say that when the upper and lower conditions are reversed, the same apparatus reversed will be equally applicable.

The amount of intermaxillary force to be applied during the period of retention should be governed by the needs of the case. It should not be at any time in excess of a force sufficient to retain the position gained — that is, providing the teeth are fully corrected when the retainer is placed — as this would necessitate stopping the force every once in a while and allowing the teeth to go back, and it is this swinging back and forth in the sockets that is especially opposed to the formation and solid fixation of a permanent retaining alveolus. It is far more advisable that the heft of the elastics be gauged to a degree that will hold the teeth perfectly while they are being worn continuously.

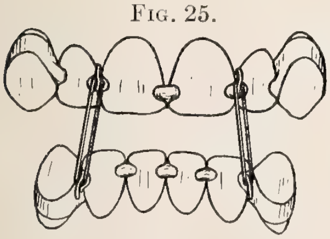
Faber No. 5 (Ticket Rings) are the same size in circumference but only about one-half the heft of No. 6 (Election Rings) which single and double are commonly used for regulating. No. 7 (Thread Bands) are the same heft as No. 6, but being about twice the size will exert less intermaxillary force than No. 5.

I frequently correct the labial malrelations of the arches and place the front teeth in proper arch alignment, then make the retaining apparatus as above before the disto-mesial malocclusion is corrected, knowing that the intermaxillary force can be gauged to any degree, and will, if properly applied, act quite as perfectly in retaining or moving the teeth as with the regulating appliance. The teeth are not so liable to be forced out of alignment and the appliance is far less conspicuous than the usual regulating appliance; moreover, the rigidity of the retainer, holding the labial curve of the arch in its corrected position, is of the greatest aid in preventing the reactive forces from laterally contracting the entire arch.

Direct Intermaxillary Retention

The correction of extensive **open bite malocclusions** has always been more difficult to retain than any other character of irregularity, because of the impossibility in most cases of obtaining a stable hold upon which to anchor a retainer that would successfully combat the force of reaction. If a lingual or labio-buccal bow is anchored to the molar teeth for this purpose, the reactive forces of the originally open bite labial teeth, will usually force the distal extremities of the bow and anchorages in the opposite direction, extruding the molars, which in itself will open the bite still further, as any movement at this point will be magnified in its action upon the front teeth. The intermediate teeth also which are employed in this method as fulcrums to the elastic force of the bow are frequently intruded.

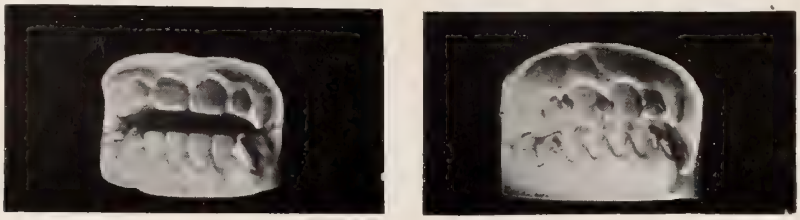
Fig. 25.



These difficulties are now overcome by soldering small **spurs** to the upper and lower labial retainers, as

shown in Fig. 25. To these are attached direct intermaxillary elastics by the patient, which are worn continuously at all times that do not interfere with required functions. This force should be continued until the forces of reaction are completely overcome.

Fig. 26.



As a large proportion of these cases are mouth-breathers at the time of the operation, — the habit having continued long after the causes are removed, — the elastics also subserve the purpose of aiding the patient in overcoming this unhealthful habit. Fig. 26 illustrates a common open bite malocclusion which was principally corrected with the retaining apparatus as shown.

Occipital Retention

In the correction of many cases of decided **upper protrusions**, — especially those in which the incisors are in an extruded position and thus in unpleasant evidence in relation to short upper lips, — and particularly when complicated with close bite malocclusions, the **occipital force**, with its upward and backward direction of movement, has proven an indispensable auxiliary in the author's practice. Again, in the correction of open bite malocclusions complicated with protruded lowers, (Type D, Class IV), the **occipital force**, through the medium of **bow B, Ap. 80**, is one of the most valuable and effective forces for closing the bite and aiding in the retrusion of the lower labial teeth after the extraction of bicuspids.

In both of these characters, the tendency of the reactive forces are often difficult to overcome for a time with dental retainers alone. Nor does one always obtain the full desired results of these movements at the time when the case is otherwise corrected and ready for the usual retaining appliances. In these cases therefore a No. 18 **iridio-platinum wire** is soldered to the interproximal extensions of the **six-band labial retainer** and in such a position as to span the central incisors, as shown in Fig. 27. The bar which crosses well above the median T extension of the appliance forms a perfect **rest** for the **occipital bow A** on the upper, and **bow B** on the lower. Small rings soldered to the bar on each side of the lips of the **rest** prevent lateral motion.

Fig. 27.

The occipital apparatus, worn at night, with a moderate degree of force will give little or no annoyance, and will exert an evenly distributed force upon all the labial teeth to which the retainer is attached. In the many cases for which

it has been employed in this way it has accomplished results that the author believes would have been otherwise impossible.

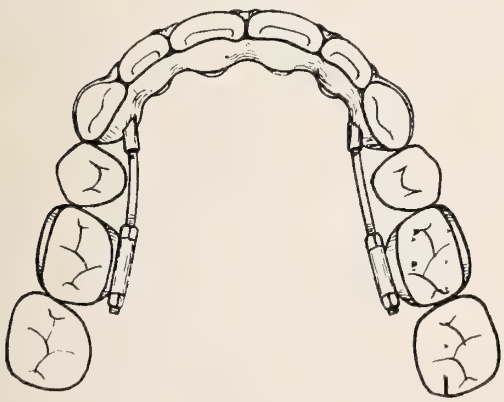
Retention of Bodily Movements

In the contemplation of retaining teeth which have been moved bodily, the magnitude and peculiarity of the force of a lever of the third kind, which in the regulating apparatus caused the apical ends of the roots to move, is quite as important to consider as in the active movement.

The retaining appliance capable of fully sustaining this movement must be one that will forcibly combat the great reacting tendency of the elastic bone and tissue fibres to return to equilibrium. As this force is exerted along the entire length of the root, it must be seen that the stress upon the comparatively narrow zone of the crown which is grasped by the retaining appliance increases as the force approaches the apical end of the root, on the same principle that the advantage of a lever of the first kind is increased by lengthening the power arm. Therefore the necessity is apparent, in this character of retention, of employing distally extended arms which are exceedingly rigid, with firm attachments to the retainer. This is especially true of bodily protruding movements of the labial teeth which so commonly carry the entire alveolar ridge forward in a manner that could not be accomplished other than by bending and stretching the cancellous structure of the alveolar process at the apical zone of its attachments. With bodily retruding movements of the labial teeth, the obstructing alveolar process in the pathway of the moving roots is to a very large extent resorbed, and consequently they are far more easily retained.

When a bodily protruding or retruding movement of the incisors has occurred which has not been accompanied by a movement of the roots of the **cuspids**, the six-band labial retainer, attached firmly, as it is, to the cuspid teeth, will greatly aid in retaining the root movement of the incisors, though it should always be supplemented with **rigidly attached lingual bars** to the molars. Fig. 28 represents the common retainer employed in these cases. **Rigid** No. 16 or 14 bars are screwed into long-bearing tubes soldered to the lingual surfaces of the regular **six-band labial retainer**. The bars rest in lingual molar open-tube attachments, with lock nuts to insure stability. In the final assembling and placing of the appliance, the bars are bent up or down so that when sprung into the tubes they will exert a slight extra force upon the roots in the direction of their movement. Then the anchorage tubes are closed around the bars and the projecting edges and corners are smoothed

Fig. 28.

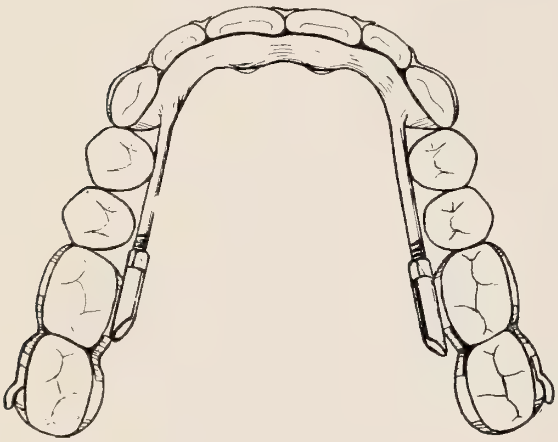


to prevent irritation of tissues. In addition to retaining the teeth, the forces of movement may be increased by bending the bars and turning the nuts.

Where extensive **bodily protruding movements** have been produced, the bands of the labial retainer should be sufficiently wide to cover the entire lingual surfaces to which they are perfectly fitted, in order to produce a wide and perfect grasp upon the crowns. When rigid bars are firmly attached to these long-bearing bands and the ends sprung into open-tube attachments on the molars, they exert a pull force at the incisal zone and a push force at the gingival zone which is transmitted to the entire root. In connection with this, if the ends of the bars are threaded for mesially acting nuts, the appliance can be made to exert a similar — though less powerful — force to that of the regular contour apparatus. See Fig. 29. Because of its inconspicuousness, it may be preferably employed from the start in minor bodily protruding movements of the incisors. In all cases where it seems desirable to remove the regular apparatus before the full completion of its work, it will be found invaluable for holding the position gained and for continuing the movement. This apparatus is described as follows:

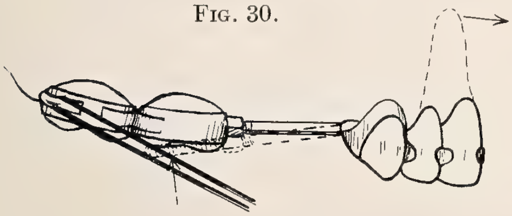
The Contour Protruding Retainer, shown in Fig. 29, is constructed with a view to combat the reaction of root movement, also to continue this force and if necessary, the bodily movement to a slight degree. To the lingual surfaces of the labial retainer (upper or lower) is soldered a German silver, or preferably, **clasp metal wire bow** No. 13 or 14. In this combination the reinforcement plate (Figs. 15 and 16, p. 382) will not be required. The contact surfaces of the bow are filed to fit the lingual surfaces of the bands. In attaching the bow to the labial bands, an abundance of solder should be flowed well over the lingual surfaces of the bands to reinforce their stability and even the surfaces from irritating prominences. The distal ends of the bow are threaded to lie in open lingual tubes upon molar anchorages which are provided with buccal **intermaxillary hooks.** The same care should be exercised in fitting the bow to lie along the lingual surfaces of the teeth, and the ends to lie evenly in the tubes, as was described in fitting the power bow in the regular contour apparatus. Finally, with this apparatus, the ends of the bow are bent at the points where they join the labial retainer toward the occlusal plane, so that in the final assembling, after the cement has hardened, the ends are sprung toward and into the open tubes which are then closed around them. The distal ends of the tubes and bow should be beveled and finished to present no irritating surfaces.

Fig. 29.



In Fig. 30, the bicuspids are removed from the drawing to show the lingual

Fig. 30.



bars. The dotted lines and arrows indicate the principles of action. It will be observed that the spring of the bow, in combination with the rigidly attached labial retainer, is calculated to exert a protruding force upon the roots. This force will be in proportion to the amount of bend that is given to the bow in the final placing, while the protruding force will be otherwise controlled by the nuts at the mesial ends of the tubes. If at any time it is desired to increase or reduce the protruding force upon the roots of the labial teeth, the bow can be easily bent with the **curved wire benders** shown elsewhere. The intermaxillary force is an important auxiliary in sustaining the stability of the anchorages and as an aid toward a general protrusion of the upper teeth and retrusion of the lower.

When this apparatus is employed principally for bodily protruding the incisor teeth, — as it may be in all minor cases,— with the view of forcing the cuspids and first bicuspids forward by inclination movement with push bars from the anchorages, or with the production of a mesial movement of all of the buccal teeth with the intermaxillary force, — the incisors should first be placed in relative alignment and the **four-band labial retainer** (Fig. 7, p. 379) should be constructed with the lingual bow attached, etc., as described above. If the cuspids and first bicuspids are to be moved forward with the view of inserting an artificial bicuspid to sustain the arch, buccal tubes should be soldered to the anchorages for No. 18 push bars to be employed for this purpose later in the operation.

CHAPTER LI

PERMANENT RETAINING FIXTURES

In most cases where the teeth have been properly corrected and a perfect retaining appliance has been subsequently worn for two years, with the attention that should be given to it, the positions of the teeth will not materially change. It unfortunately is a fact, that occasionally after a perfect and seemingly adequate retention, there are instances in which the teeth when unrestrained will move more or less back toward their former malpositions.

As it is impossible to determine in each case the absolute time that a fixture should be worn to insure permanency of retention, it has been the custom of the author to insist upon keeping the appliance on the teeth much longer than would ordinarily seem necessary. As the result of experience in this department, the time limit for wearing retaining fixtures has gradually lengthened, in the last twelve years, from about six months to two years; and in some instances of marked inherited irregularities, they are now worn three years.

As the need of lengthening the retaining period has developed, it has called for a gradually increasing perfection of the retaining appliance to avoid injuring the teeth, and to present an acceptable appearance. The need of such an appliance produced the retaining fixtures and methods described in the two previous chapters. It now remains to describe a final method of retention, for the treatment of those comparatively few cases which demand a **permanent fixture,** or at least one that will need to be worn many years, indeed too long to ask a patient to keep in the mouth an appliance that in any way mars the natural appearance of the teeth, to say nothing of the increased danger to the teeth that is caused by cemented bands worn during longer periods.

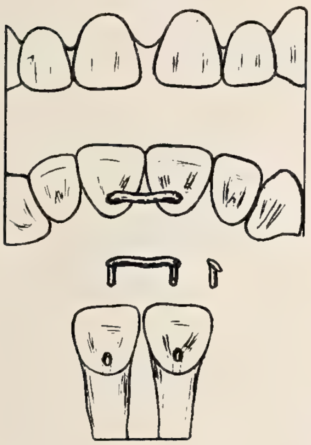
The most conspicuous of the irregularities which demand a permanently attached fixture is that which is characterized by **abnormal interproximate spaces** between the upper incisors, most frequently found between the central incisors, and which are commonly impossible to retain without a permanent fixture. It is placed as Group V, in the Simple and Complex Irregularities of this work, where the causes and treatment will be found fully described with specific methods of correction under **Aps. 59, 60, 61, and 62.**

The teeth which assume this special irregularity present the most continued opposition to retention after correction of any of the malpositions, even though the apparent local cause be wholly removed. In a number of instances of this character which were perfectly retained for two years, upon removal of the retainer, the teeth soon showed signs of returning to their former malpositions; and

with no apparent cause for it other than the unaccountable forces of Nature. Therefore, if we hope to correct this irregularity which frequently mars perfect enunciation and is conspicuously unpleasant in appearance, the proposition of permanent retention must be considered. Any form of band retainer is objectionable because of its appearance and possible injury to the teeth.

The retainer which I have employed with the greatest satisfaction, where the space is between the centrals, is in the form of a staple, which doubtless has been used for years in various forms and positions.* When constructed according to the methods here proposed and properly placed in position, it is seen only upon the lingual aspect as a flattened gold bar which extends from the lingual fossa of one tooth to the other, formed and finished to present the least possible obstruction and irritation to the tongue. See Fig. 31.

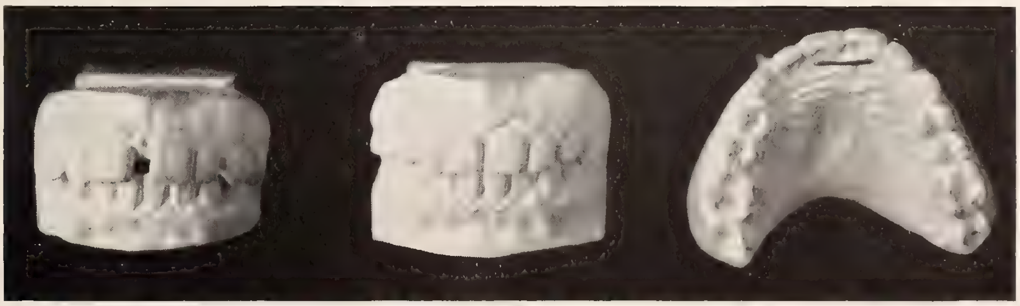
Fig. 31.



This may be made of No. 16 gold wire. The ends are bent at right angles at the proper distance apart and filed down to enter No. 19 holes bored in the teeth, as will be described. The No. 16 wire is of sufficient size to permit beveling the bar to fit the beveled borders of the holes, marginal ridges of the teeth, and conform to the interproximate gingivæ. The exposed or lingual surface of the bar is also beveled in a line with the plane of the enamel surfaces and finished to present no greater prominences than demanded for strength.

A staple retainer of this character was constructed for one of Dr. Thos. L. Gilmer's patients in 1894, since which time it has been worn without removal, and with no perceptible change or injury to the teeth. This is shown in Fig. 32. The two casts on the left are before and after correction. That on the right is from an impression taken over ten years afterward, with the appliance on the teeth.

Fig. 32.

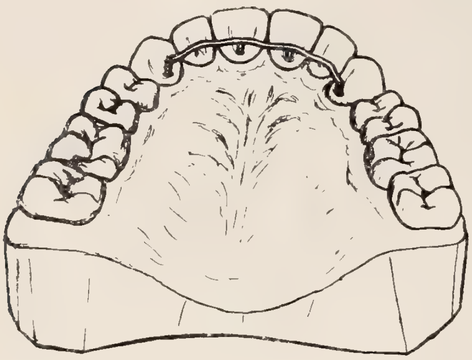


Dr. J. W. Wassall has suggested a very practical modification in the technic construction of this retainer, especially applicable when employed to retain more than two teeth (See Fig. 33.):—When the pits in the teeth are prepared, place

*Presented at the meeting of the Odontological Society, April, 1903, and published in the Dental Review, February, 1904.

in them short straight posts of No. 19 gold wire and take a plaster impression. To insure pulling the posts out of the pits with the impression, they may be roughened or the projecting ends bent. When the impression is filled with investing material, and carefully separated so as to avoid dislodging the posts from the cast, it will enable one to solder to them the spanning bar. After which the surplus projecting ends are cut away and the appliance finished and placed as before. Fig. 33 shows an appliance of this kind placed in a position to be forced to its final seating, for uniting the centrals and cuspids.

Fig. 33.



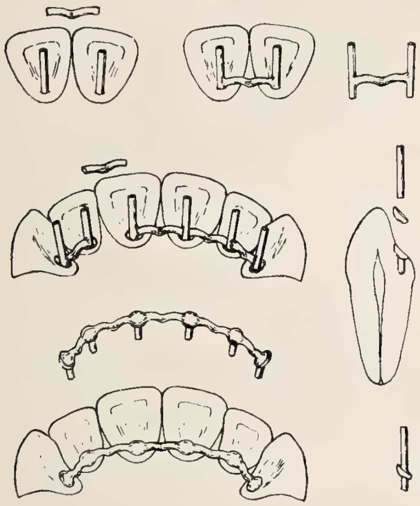
The spanning bar should be shaped to conform to the line of lingual ridges of the teeth and gingivæ over which it rests, being careful that it freely spans the median interproximate gingivæ, as any pressure upon the tissue at this point will cause inflammation and swelling. Moreover, there should be no attempt to make it fit accurately to the teeth, as might be accomplished by grinding grooves in the marginal ridges. In fact, it would be better to leave the under surface of the bar rounded and sufficiently free from the enamel to allow the removal of accumulations, with dental floss, etc. In fitting the bar on the model, place it at one side of the projecting posts, either occlusally or gingivally as seems best to meet the requirements, and avoid occlusal contact; or separate bars may be fitted between the posts.

One of the objections to this method, as described, arises from the difficulty of retaining the exact relative positions of the posts in the process of construction, to secure the desired nicety of adaptation. As the posts need not extend into the teeth more than three thirty-seconds of an inch (about three millimeters), and consequently the same distance into the cast, it will be found quite difficult to prevent their dislodgement from the cast or changing their positions slightly, in the process of separating, etc. This may be obviated by the following very ingenious and skillful method, described by Dr. Hart J. Goslee, who recently constructed a six post retainer for one of my patients, which for accuracy and perfection of finish establishes the importance and practicability of permanent fixtures for the six upper front teeth.

"The permanent retention of the four incisor teeth, sustained by the cuspids, and without the display of any metal whatever, was effected by employing the staple attachment in the following manner. Longitudinal holes about the size of 20 gauge round iridio-platinum wire, and to the depth of about $\frac{1}{16}$ of an inch, were drilled in the lingual surfaces of the six anterior teeth, as previously indicated. Pins of approximately this size and type of wire, and about one half inch in length, were made and fitted to the holes. Those for the two centrals were placed in position and a small impression of the lingual surfaces of the teeth and projecting

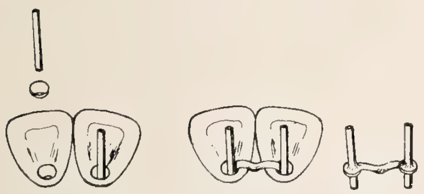
surplus ends of pins was then taken in **wax.** When this was removed and filled with investment material, and the wax warmed and separated from the model, the two were then united by fitting **a bar** in between them (Fig. 34) and soldering with 25 per cent platinum solder, thus obtaining a right angle union at the junction of each pin with the supporting tooth. When this piece was properly adjusted to the two centrals, another piece attaching the laterals to the cuspids, on each side, respectively, was similarly constructed, after which the **three** individual pieces, each uniting two teeth, were placed in position and an impression of all taken also in **wax.** A model of investment material was again obtained and the three then assembled into one by fitting in small pieces of wire between the centrals and laterals, and soldering these with 25 per cent platinum solder. After adjusting this assembled fixture to position, and for the purpose of obtaining a closer surface and marginal adaptation of each individual pin at the point where it enters the tooth, the **orifice** of each hole was then enlarged with a good-sized round bur, and small **disks** of 34 gauge pure gold were then perforated to fit over each pin, and subsequently burnished and trimmed to the proper outline against the enlarged orifice. These disks were then retained in their proper relation to the respective teeth and pins with a small quantity of **hard wax,** after which the whole was removed and the disks attached to the wire with 22 or 20 karat gold solder, thus affording an **inlay effect,** with free and self-cleansing marginal edges, in the attachment of each pin to each tooth. The surplus ends of the pins were then cut off, and the fixture finished as indicated in Fig. 34."

Fig. 34.



It may be found more convenient to fit the disks to the posts before attaching the bars, as in Fig. 35.

Fig. 35.

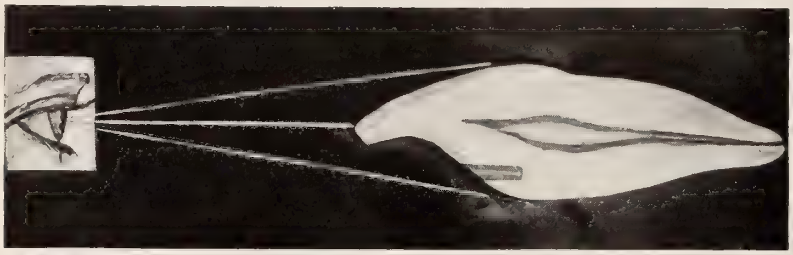


As the operation of boring holes in the teeth sufficiently deep for **permanence** of retention is attended with the risk of entering the pulp chamber, or on the other hand of perforating the peripheral wall of the root, special thought should be given to the anatomical structure of the teeth with the view of determining the exact location of the pulp and the relative thickness of the dental wall at the location of the contemplated operation.

By making a labio-lingual section of a central incisor, as shown in Fig. 36, it will be found that the thickness and shape of the linguo-cervical wall will safely permit the boring of a hole of sufficient size and depth, if started in a line with the **middle** of the wall and carried **parallel to the central axis** of the tooth.

The location and direction of the proposed hole can easily be determined by the eye. In gazing rootwise at a labial tooth, take such a position as will bring the cutting edge exactly in the center between the gingivo-labial and gingivo-lingual borders of the crown and you will be looking directly along the line of the central axis of the tooth.

Fig. 36.



Use a No. 19 drill and start the hole in the lingual fossa at a point whose line of direction, parallel to the central axis, will leave sufficient body on the lingual side of the pit, and then bore to the depth of about three millimeters. In a typically formed central incisor of ordinary size, the thickness of the linguo-gingival wall is about three millimeters to the depth of at least six millimeters. The diameter of a No. 19 drill is about .035 of an inch. One millimeter is over .039 of an inch. Consequently, if the proper course is pursued, you are safely one millimeter from either wall. The holes should be perfectly parallel with each other, with margins very slightly countersunk, and no larger than demanded to closely fit the posts.

The safety and continued permanency of this form of appliance lies in the fact that the holes can be bored without injury to the adjoining enamel; but no attempt should be made to cover in the surrounding enamel surfaces with small pieces of plate or washers, however accurately they may be fitted, because the intervening cement will soon wash out and leave pockets for decaying detritus which will ultimately cause decay of the teeth. On the contrary, the bar where it leaves the pins and passes over the marginal ridges should lie upon the natural enamel surfaces with free rounded contact, so as to permit perfect cleansing.

One is occasionally called upon to treat patients older than 25 years of age with protruding upper incisors, having wide interproximate spaces between the centrals and at times between all of the labial teeth, which are not caused or held in that position by the occlusion of the lower teeth.

There should be no hesitation in regard to correction in these cases, even though the apparent cause is pyorrhea. In fact with proper preliminary treatment nothing will tend more favorably to throw off the dormant conditions of pyorrhea and restore health than the required movement of the teeth. In many instances, the irregularity may have arisen from inherent tendencies, or later from the thumb-sucking habit, which forced the deciduous and permanent labial arch forward. In any event there seems to be no accounting for that continued wide-spaced

malposition of the incisors opposed constantly, and perhaps from the time of their eruption, by the contruding force of the labial muscles.

If the cuspids are not involved in the protrusion, and if after retruding the incisors they will not retain their position, — which is very likely, even after having been held perfectly with the labial retainer for two years, — they can be surely and safely retained with the **permanent retaining fixture** shown in Figs. 33 and 34. This may at times be attached only to the cuspids and central incisors. The fact that it is completely out of sight and can be easily removed at any time and the small holes filled with gold, makes this form of retainer superior to the six-band appliance in all cases of this character which require very long or permanent retention. In those cases in which it is applicable, that seem to demand a permanent fixture, and also those which indicate the need of retention an unusual length of time, this method is the only one employed by the author.

In recommending this appliance, which doubtless will appeal to many because of its apparent simplicity and ease of construction, it is hoped that a careful and skillful application of the rules laid down for boring and preparing the holes will be closely observed. This is by far the most important part of the operation. The next is in the accuracy of fittings at the margins of the holes which according to the methods illustrated in Figs. 34 and 35 can be perfectly accomplished. The bars should conform somewhat to the shape of the surfaces over which they lie, and take the position best calculated for freedom from the tongue and lower teeth. This can be accomplished on the model preparatory to soldering to the pins; the final adjustments to correct slight imperfections being made at the chair preparatory to cementing the completed fixture.

INDEX